

A CLASSIFICATION OF THE BEES OF THE AUSTRALIAN AND SOUTH PACIFIC REGIONS

CHARLES D. MICHENER

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CHARLES D. MICHENER

Research Associate, Department of Entomology

The American Museum of Natural History

Watkins Professor of Entomology

The University of Kansas, Lawrence

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CONTENTS

INTRODUCTION	5
Scope	5
Acknowledgments	5
What are Bees?	8
Biogeographical Conditions	9
Flower Relationships of Australian Bees	21
Previous Work on Bees of Australia and the South Pacific	24
Methods and Explanations of Symbols	25
Morphological Terms	27
SYSTEMATIC TREATMENT.	33
Key to the Families of the Apoidea of the Australian Region.	33
Artificial Key to the Groups of Bees of the Australian Region	33
Family Colletidae.	35
Subfamily Colletinae	35
Subfamily Stenotritinae	80
Subfamily Euryglossinae.	83
Subfamily Hylaeinae	114
Family Halictidae	151
Subfamily Nomiinae	152
Subfamily Halictinae	161
Family Melittidae	183
Subfamily Ctenoplectrinae.	183
Family Megachilidae	184
Subfamily Lithurginae	184
Subfamily Megachilinae	185
Family Anthophoridae	214
Subfamily Nomadinae.	214
Subfamily Anthophorinae	214
Subfamily Xylocopinae	219
Family Apidae	229
Subfamily Bombinae	229
Subfamily Apinae.	229
APPENDIX 1. FLOWER RECORDS AND OTHER COLLECTING DATA	233
APPENDIX 2. DESCRIPTIONS OF NEW SPECIES AND OTHER DESCRIPTIVE DATA.	245
APPENDIX 3. DERIVATIONS OF THE NEW GENERIC AND SUBGENERIC NAMES	324
LITERATURE CITED	325
ADDENDA	338
INDEX.	339

INTRODUCTION

SCOPE

THE PRESENT PAPER is designed to make possible the identification of the Apoidea of the Australian and South Pacific regions to the genus and subgenus level. It was begun at the request of several Australian entomologists because recognition of the groups of Australian bees has been difficult with previously existing literature. So far as known, all described species are listed, so that this paper also constitutes a checklist, with references to original descriptions, of bees of the area covered. A classification such as this, even though obviously imperfect and incomplete, has value because the species are, often for the first time, placed in what appear to be natural groups. That more such groups will be found with added collecting is obvious if one considers the number of groups now known from only a specimen or two. Moreover, more refined studies of some of the large groups may show that they can be advantageously subdivided; in a few cases they are probably artificial assemblages. Many such matters can be decided only when more species are discovered and especially when field work makes available both sexes of many species now known from only one. If the present paper makes it practical for Australian students to engage in the study of their large and interesting bee fauna, it will have served one of its major purposes.

In addition, it is hoped that certain sections constitute significant contributions to the general systematics of bees.

Bees are particularly favorable objects for study by Australian biologists because of their abundance in Australia, the ease with which they can be collected, their fascinating and varied behavioral characteristics, involving both nest building and flower relationships, and their economic importance as pollinators of both native vegetation and agricultural crops. The titles that appear in the Literature Cited should include an essentially complete list of the important papers

on Australian bees, although in a few cases papers of no great importance can be got at only through the bibliography in some more recent paper that is cited. The list seems imposing, but many of the titles are there in connection with bees of the Pacific islands rather than Australia. Fortunately for the Australian student, the great majority of the publications on Australian bees are in the English language and appeared in British, Australian, or American journals that are not too difficult to obtain in Australian libraries.

The area covered by this study includes Australia and Tasmania, together with the Pacific islands south of the equator and east of Weber's line. Figure 1 shows the area and the main island groups involved. Except for the northern Moluccan islands, no areas north of the equator are included.

The study began as a work on the bees of Australia alone. However, there is scarcely a genus in New Guinea that does not also reach the Australian continent. It was therefore decided to include New Guinea in the area under consideration. Since the bee fauna of the islands to the east of Australia and New Guinea is merely a depauperate extension of the fauna of those areas, the South Pacific islands, eastward as far as bees exist, were also included in our area. The problem then remained of where to draw the line in the northwest. Weber's line (fig. 1), excluding Tanimbar and Timor (see Dickerson, 1928), was selected as the northwestern limit since only one or two Asiatic genera or subgenera cross it and occur in the Moluccas without also reaching New Guinea. Only one typically Australian and Papuan genus (*Palaeorhiza*, two subgenera) is known to cross in the other direction. *Gephyrohylaenus* from Borneo and New Guinea cannot be definitely regarded as either Asiatic or Australian and Papuan. Further zoogeographical details are given in another section.

ACKNOWLEDGMENTS

The studies that led to this work were begun during the tenure of a research grant provided by the Fulbright program of the

United States Government and administered by the United States Educational Foundation in Australia. Thanks to this grant, I was able

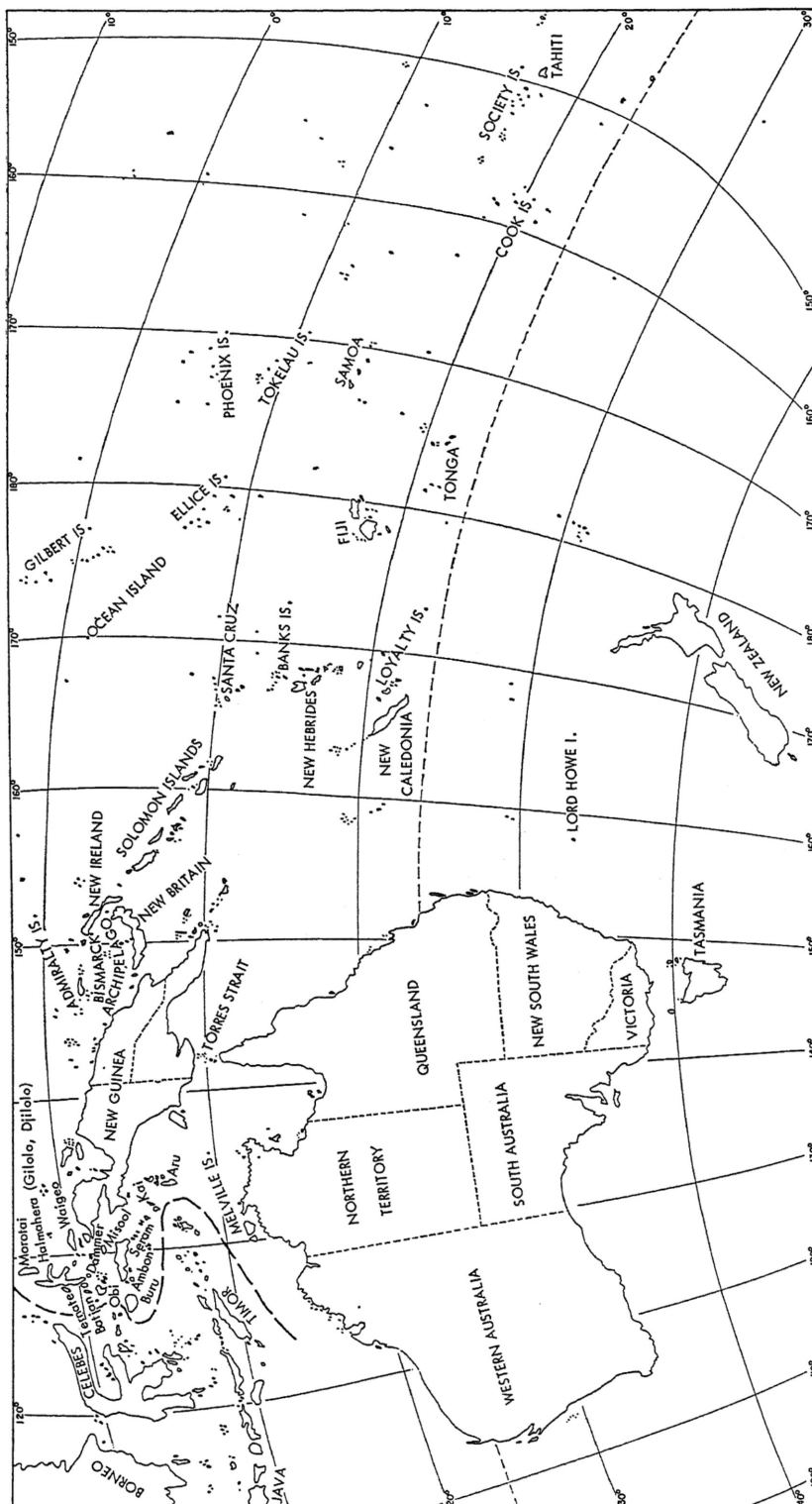


Fig. 1. Map of the area covered by the present study. The broken line west of the Moluccas indicates the northwest limit; otherwise bees from all areas shown are considered.

to spend a year in Australia, with headquarters in the Department of Entomology, University of Queensland. Thanks are due to the authorities of that institution and especially to Mr. F. A. Perkins, Reader in Entomology and head of the Department of Entomology, University of Queensland, for excellent facilities provided and for much help and cooperation. Several members and students of that department were also very helpful, especially Dr. E. N. Marks, Miss Elizabeth Exley, Dr. T. E. Woodward, Mr. Saran Singh Sekhon, and Mr. Ian Yoe.

Numerous persons at various other Australian institutions were very gracious, not only in tolerating my visits, permitting examination of material under their care, and arranging for field work, but also in lending specimens for study. These included Mr. S. L. Allman and Mr. C. E. Chadwick (Department of Agriculture, Sydney); Mr. David O. Atherton (Department of Agriculture and Stock, Cairns, Queensland); Mr. M. Bengston (Department of Agriculture and Stock, Stanthorpe, Queensland); Dr. C. W. Brazenor, Mr. A. N. Burns, and Mr. A. Neboiss (National Museum of Victoria, Melbourne); Dr. John W. Evans and Mr. David McAlpine (Australian Museum, Sydney); Dr. H. M. Hale and Mr. Gordon Gross (South Australian Museum, Adelaide); Mr. C. F. H. Jenkins (Department of Agriculture, Perth); the late Mr. George Mack (Queensland Museum, Brisbane); Prof. A. P. O'Farrell and Dr. E. T. Giles (University of New England, Armidale, New South Wales); Dr. W. D. L. Ride, Mr. A. Douglas, and Dr. Gerlof F. Mees (Western Australian Museum, Perth); Dr. E. F. Riek (Commonwealth Scientific and Industrial Research Organization, Canberra); the late Dr. Duncan L. Swan and Dr. Keith Doull (Waite Agricultural Institute, Adelaide); and Mr. E. Wilson (Melbourne).

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In addition to material in the above museums, which I visited personally, I was able to borrow type material of Australian bees for study thanks to the cooperation of Dr. Miklós Móczár, Hungarian National Museum, Budapest.

Funds for my travel to the British and Vienna museums and certain help in making dissections and the like were provided for by Grant G-12347 of the National Science Foundation, while certain work concerning halictine bees was facilitated by Grant GB-91. A grant for assistants was also made from the Graduate Research Fund of the University of Kansas.

Padre J. S. Moure of the Universidade do Paraná kindly examined the manuscript and made many useful suggestions. I am especially indebted to him for the use of his manuscript catalogue of South American bees (1957 version) which was valuable in preparing my

treatment of *Leioproctus* (with which he does not agree, as he would divide the genus considerably more finely).

Dr. M. A. Lieftinck has read much of the manuscript and made many invaluable suggestions. I greatly appreciate his help, which has been especially important in connection with the Indonesian fauna with which he is thoroughly familiar.

I am especially indebted to Dr. E. F. Riek for lending me the numerous types in the T. Rayment collection which was purchased by the Commonwealth Scientific and Industrial Research Organization, Canberra, after my

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WHAT ARE BEES?

The superfamily Apoidea consists of the insects commonly called, in English, bees. Unfortunately, in common usage, the word "bees" connotes honeybees and their social relatives. An equivalent of the German word "*Blumenwespen*" (flower wasps) would be better, for the Apoidea are basically sphecoid wasps that use, as a protein source, pollen rather than insect or spider prey; most of them are not social as are the honeybees and their allies.

Some of the primitive bees are very similar to the sphecoid wasps but can be distinguished by the presence of at least a few branched hairs on the body (often difficult to see) and by having the hind basitarsi wider than the following segments. In wasps the basitarsi are ordinarily of about the same width as the following tarsal segments.

So defined, the bees constitute a group of some 20,000 species in the world, ranging from minute forms only 2 mm. long to enormous ones attaining 39 mm. in length. Although very diversified in size, structure, and appearance, the bees are not readily divisible into a few sharply defined major groups of equivalent status. For this reason their classification has never reached the stage of general agreement. Some entomologists would place them all in a single family, the Apidae, while others divide them into two or several families. The classification adopted here is that of Michener (1944), with certain modifications. The bees are divided into eight families, as follows: Colletidae, Halictidae, Andreni-

dae, Melittidae, Fideliidae,¹ Megachilidae, Anthophoridae,² and Apidae.³ The Andrenidae and Fideliidae do not occur in our area, and the Melittidae scarcely do. A summary of the classification here adopted for Australian bees appears in table 2.

The great majority of bees are solitary creatures, i.e., each female makes her own nest, without the cooperation of others. In this case there are no separate queen and worker castes, for each female must engage in the activities of both worker and queen if progeny are to be produced. The nest typically consists of a burrow in the soil, in wood, or in a pithy stem, from which lateral burrows extend to the cells, or which is itself subdivided into cells. Some solitary bees, however, construct cells of pebbles and resin, mud, or other materials in protected or exposed situations. Normally each cell is completed, provisioned with pollen and honey, an egg is laid in it, and it is sealed, before the next cell is begun (but in many of the Halictidae this sequence is broken and new cells

¹ Not regarded as a family by me in 1944, but see Moure and Michener (1955).

² Not regarded as a family by me in 1944, but I believe that at that time I was overimpressed by the tradition of heavily weighting characters of mouthparts in bees. In the totality of its characters this group merits family rank if the first four families do. The Xylocopinae of my earlier treatment are now included in the Anthophoridae.

³ Because of the removal of the Fideliidae and Anthophoridae, this is equivalent to the subfamily Apinae of my 1944 treatment.

are started before their predecessors are completed). The mother ordinarily dies before her progeny reach maturity and emerge from their cells.

Among the Halictidae from our area, several females commonly occupy a single nest, but all mate and lay eggs; no castes exist. (In other continents there are halictids with functionally distinct queens and workers.) In the ceratinine genera *Allodapula* and *Exoneura*, several females also often inhabit a nest, but they are not alike in their activities. Although externally similar, one is the egg layer or queen, while the others do most of the foraging and function as workers. These genera are unusual in that they do not have a separate cell for each young but rear the larvae all together in the nest burrow, feeding them day by day, progressively, instead of by providing all the necessary food before laying an egg as do most bees.

Distinctly different queen and worker castes and large colonies exist, among bees of our area, only in the Apidae which contain the genera *Bombus*, *Apis*, and *Trigona*.

The study of nesting behavior of bees of our area has not received the attention that it deserves. Tarlton Rayment has published numerous articles and a book (1935) largely devoted to such matters, but in many ways

these works are not satisfying. Hacker and a few others have published a note or two, and I have written several papers on nesting habits of bees from our area.

There exist some bees, called socially parasitic or cuckoo bees, which do not make their own nests. The larvae feed on provisions provided by the host, which in every case is some other species of bee. Cuckoo bees are scarcer in our area than in any other major part of the world, perhaps because so many Australian bees are in the Colletidae, a family that contains few if any parasitic representatives. (Only a few Hawaiian species of *Hylaeus* are said to be parasitic, among the many species of Colletidae.) The best-known parasitic genus in Australia is *Thyreus*, which parasitizes *Amegilla*. The other parasitic forms in our area are: *Sphecodes* and *Nomada* (only one or two Australian species each, possibly parasitic on *Lasioglossum*), *Echthralictus* from Samoa, presumably parasitic on *Homalictus*, *Coelioxys* (few species in our area, parasitic on *Megachile*, *Chalicodoma*, and *Creightoniella*), *Parevaspis* (one species barely entering our area, parasitic on *Lithurge* and *Megachile*), *Inquilina* (one or a few species, parasitic on *Exoneura*), and two species of *Allodapula* (parasitic on other *Allodapula*).

BIOGEOGRAPHICAL CONDITIONS

THE AUSTRALIAN BEE FAUNA

Australia has the most distinctive continental bee fauna in the world. It is the only continent where most of the genera and nearly half of the named species of bees belong to the family Colletidae (the most primitive family of bees, with mouthparts like those of wasps). To illustrate this point, there are only two genera of Colletidae in Eurasia and about six in North America (including Mexico). In South America and Africa the genera are somewhat more numerous, but in Australia the family has undergone extensive radiation; there are 32 genera, several of which are large and quite diversified so that many subgenera have been described. There are 82 named genera and subgenera from our area, and a generic concept such as has been employed in some areas (especially South Amer-

ica) would certainly result in more than 100 Australian genera of Colletidae. The colletid subfamilies Stenotritinae and Euryglossinae are found only in Australia. Not only is Australia very rich in Colletidae, but it nearly or completely lacks several groups which are otherwise worldwide or nearly so. The outstanding examples are the Andrenidae, absent in Australia, and the Melittidae, represented in that continent by a single species in northern Queensland. Several groups that occur on all continents and are abundant on all others reach Australia only in Queensland where they are represented by only one or two species (e.g., *Nomadinae*, *Anthidiini*).

To indicate further how distinctive the Australian fauna is, table 1 has been prepared to show the distribution by major faunal regions of the tribes and higher categories of bees. The faunal regions are used in their

TABLE 1
DISTRIBUTION OF TRIBES AND HIGHER CATEGORIES OF BEES

Taxa	Australian	Oriental	Ethiopian	Palaearctic	Nearctic	Neotropical
Colletidae						
Paracolletini	++++	—	+	—	+	++
Colletini	—	+	++	++	++	++
Stenotritinae	+	—	—	—	—	—
Diphaglossinae	—	—	—	—	+	++
Euryglossinae	++++	—	—	—	—	—
Hylaeinae	++++	++	++	++	++	++
Chilicolinae	—	—	—	—	+	++
Andrenidae						
Andreninae	—	+	+	+++	+++	+
Melitturgini	—	—	—	+	—	—
Panurgini	—	—	+	++	+++	+++
Oxaeinae	—	—	—	—	+	++
Euherbstiinae	—	—	—	—	—	+
Halictidae						
Dufoureae	—	+	+	++	++	+
Nomiinae	++	++	++++	++	+	+
Halictinae	+++	+++	+++	+++	+++	+++
Melittidae						
Melittinae	—	—	+	+	+	—
Dasypodinae	—	—	+	+	+	—
Macropodinae	—	—	—	+	+	—
Ctenoplectrinae	+	+	+	—	—	—
Fideliidae						
Fideliidae	—	—	+	—	—	+
Megachilidae						
Lithurginae	+	+	+	+	+	+
Anthidiini	+	++	++	++	++	++
Megachilini	+++	+++	+++	+++	+++	+++
Anthophoridae						
Exomalopsinae	—	—	+	+	+	+++
Nomadinae, <i>s. l.</i>	+	+	++	++	++	++
Melitomini	—	—	—	—	++	++
Eucerini	—	+	++	++	+++	+++
Anthophorini	++	++	+++	++	++	++
Centridini	—	—	—	—	+	+++
Melectini	+	++	++	++	++	+
Rhathymini	—	—	—	—	—	+
Ctenioschelini	—	—	—	—	+	++
Ceratinini	++	++	+++	++	++	++
Xylocopini	+	++	++	++	+	++
Apidae						
Euglossinae	—	—	—	—	—	++
Bombinae	Introduced	+	—	++	++	+
Meliponini	+	++	++	—	—	++++
Apinae	Introduced	++	+	+	Introduced	Introduced

widely accepted sense (see Darlington, 1957, p. 427). The number of plus signs in table 1 were assigned subjectively to give some idea of the number and diversity of kinds of each group in each area.

It is evident that if one dropped from the table the groups found in all continents (e.g., Halictinae, Megachilini, Anthophorini, Ceratinini) and those represented in Australia by only a species or two (Ctenoplectrinae, An-

thidiini, Nomadinae), nearly all the remaining forms found in that continent would be Colletidae.

DIVERSITY OF BEE FAUNAS

As can be seen from table 2, there is considerable diversity in the bee fauna in different parts of our area. In Australia itself two very different faunas meet. The large, typically Australian element, conspicuous in the

TABLE 2

THE CLASSIFICATION AND DISTRIBUTION OF BEES IN THE AUSTRALIAN AND SOUTH PACIFIC REGIONS (The number of plus signs indicates subjectively the relative abundance of each group in each area. For Australia: E is eastern; W, western; N, northern, usually northern Queensland; N₂, northern half of continent. Absence of letters for a form occurring in Australia indicates that it is widespread, although in many cases the range is probably limited to the southern half or two-thirds of the continent. In the column Names, unplaced forms have been omitted, as have those listed here only from Java. The symbol I means introduced.)

Taxa	Java	New Gui- nea	Solo- mon Islands	New Heb- rides	New Cale- donia	Fiji- Tahiti	Australia	Tas- mania	New Zea- land	Names
COLLETIDAE										853
Colletinae										294
Paracolletini										294
<i>Callomelitta</i>	—	—	—	—	—	—	+	+	—	14
<i>Leioproctus</i>										237
<i>Leioproctus</i> , s. str.	—	+	—	—	—	—	++++	++	+	120
<i>Nesocolletes</i>	—	—	—	—	—	—	—	—	+	5
<i>Cladocerapis</i>	—	—	—	—	—	—	+	—	—	13
<i>Microcolletes</i>	—	—	—	—	—	—	++	—	—	14
<i>Protomorpha</i>	—	—	—	—	—	—	+E	—	—	1
<i>Excolletes</i>	—	—	—	—	—	—	+E	—	—	1
<i>Colletopsis</i>	—	—	—	—	—	—	+W	—	—	1
<i>Urocolletes</i>	—	—	—	—	—	—	+W	—	—	1
<i>Anacolletes</i>	—	—	—	—	—	—	+W	—	—	4
<i>Glossurocolletes</i>	—	—	—	—	—	—	+W	—	—	2
<i>Nodocolletes</i>	—	—	—	—	+	—	++	+	—	17
<i>Ceratocolletes</i>	—	—	—	—	—	—	+W	—	—	2
<i>Goniocolletes</i>	—	—	—	—	—	—	++	—	—	22
<i>Euryglossidia</i>	—	—	—	—	—	—	++	—	—	21
<i>Filiglossa</i>	—	—	—	—	—	—	+E	—	—	1
<i>Notocolletes</i>	—	—	—	—	—	—	+	—	—	1
<i>Baeocolletes</i>	—	—	—	—	—	—	+	—	—	3
<i>Colletellus</i>	—	—	—	—	—	—	+W	—	—	1
<i>Andrenopsis</i>	—	—	—	—	—	—	+	—	—	4
<i>Chrysocolletes</i>	—	—	—	—	—	—	+E	—	—	2
<i>Phenacolletes</i>	—	—	—	—	—	—	+W	—	—	1
<i>Neopasiphae</i>	—	—	—	—	—	—	+W	—	—	3
<i>Hesperocolletes</i>	—	—	—	—	—	—	+W	—	—	1
<i>Paracolletes</i>										18
<i>Paracolletes</i> , s. str.	—	—	—	—	—	—	++	—	—	9
<i>Anthoglossa</i>	—	—	—	—	—	—	++	—	—	9

TABLE 2—(Continued)

Taxa	Java	New Gui- nea	Solo- mon Is- lands	New Heb- rides	New Cale- donia	Fiji- Tahiti	Australia	Tas- mania	New Zea- land	Names
<i>Trichocolletes</i>										21
<i>Trichocolletes</i> , s. str.	—	—	—	—	—	—	++	+	—	20
<i>Callocolletes</i>	—	—	—	—	—	—	+W	—	—	1
Stenotritinae										18
<i>Stenotritus</i>	—	—	—	—	—	—	+	—	—	10
<i>Ctenocolletes</i>	—	—	—	—	—	—	+	—	—	8
Euryglossinae										221
<i>Euryglossa</i>										133
<i>Euhesma</i>	—	—	—	—	—	—	+++	+	—	41
<i>Dermatohesma</i>	—	—	—	—	—	—	+W	—	—	1
<i>Parahesma</i>	—	—	—	—	—	—	+E	—	—	1
<i>Euryglossa</i> , s. str.	—	—	—	—	—	—	+++	+	—	59
<i>Callohesma</i>	—	—	—	—	—	—	++	—	—	21
<i>Xenohesma</i>	—	—	—	—	—	—	+	—	—	10
<i>Xanthesma</i>	—	—	—	—	—	—	+	—	—	4
<i>Heterohesma</i>	—	—	—	—	—	—	+E	—	—	1
<i>Melittosmithia</i>	—	—	—	—	—	—	+E	—	—	4
<i>Stenohesma</i>	—	—	—	—	—	—	+N	—	—	1
<i>Stilpnosoma</i>	—	—	—	—	—	—	+N	—	—	2
<i>Holohesma</i>	—	—	—	—	—	—	+E	—	—	3
<i>Dasyhesma</i>	—	—	—	—	—	—	+W	—	—	1
<i>Hyphesma</i>	—	—	—	—	—	—	+	—	—	5
<i>Pachyprosopis</i>										21
<i>Pachyprosopis</i> , s. str.	—	—	—	—	—	—	++	—	—	11
<i>Pachyprosopula</i>	—	—	—	—	—	—	++	+	—	9
<i>Pachyprosopina</i>	—	—	—	—	—	—	+W	—	—	1
<i>Euryglossina</i>										33
<i>Euryglossina</i> , s. str.	—	—	—	—	—	—	++	+	—	16
<i>Turnerella</i>	—	—	—	—	—	—	++	—	—	13
<i>Euryglossella</i>	—	—	—	—	—	—	+E	—	—	3
<i>Microdontura</i>	—	—	—	—	—	—	+E	—	—	1
<i>Euryglossula</i>	—	—	—	—	—	—	+	—	—	5
<i>Brachyhesma</i>										8
<i>Microhesma</i>	—	—	—	—	—	—	+	—	—	4
<i>Brachyhesma</i> , s. str.	—	—	—	—	—	—	+	—	—	4
Hylaeinae										320
<i>Hylaeus</i>										196
<i>Prosopisteron</i>	—	+	—	—	—	—	+++	++	+	74
<i>Edriohylaeus</i>	—	—	—	—	—	—	+E	—	—	2
<i>Rhodohylaeus</i>	—	—	—	—	—	—	++	—	—	22
<i>Hylaeteron</i>	—	—	—	—	—	—	+	—	—	3
<i>Gnathoprosopoides</i>	—	—	—	—	—	—	+E	+	—	6
<i>Gnathoprosopis</i>	—	—	—	—	—	—	++	—	—	17
<i>Sphaerhylaeus</i>	—	—	—	—	—	—	+	—	—	2
<i>Euprosopis</i>	—	—	—	—	—	—	++	+	—	32
<i>Euprosopoides</i>	—	—	—	—	—	—	++	—	—	19
<i>Euprosopellus</i>	—	—	—	—	—	—	+	—	—	4
<i>Macrohylaeus</i>	—	—	—	—	—	—	+	—	—	3

TABLE 2—(Continued)

Taxa	Java	New Guinea	Solomon Islands	New Hebrides	New Caledonia	Fiji-Tahiti	Australia	Tasmania	New Zealand	Names
<i>Meghylaenus</i>	—	—	—	—	—	—	+	—	—	3
<i>Pseudhylaenus</i>	—	—	—	—	—	—	+	+	—	5
<i>Xenohylaenus</i>	—	—	—	—	—	—	+E	—	—	4
<i>Heterapoides</i>	—	—	—	—	—	—	+E	—	—	7
<i>Gephyrohylaenus</i>	?	+	—	—	—	—	—	—	—	1
<i>Anastoroides</i>	—	—	—	—	—	—	+E	—	—	1
<i>Pharohylaenus</i>	—	—	—	—	—	—	+N	—	—	1
<i>Hylaeorhiza</i>	—	—	—	—	—	—	+E	+	—	6
<i>Palaeorhiza</i>	—	—	—	—	—	—	—	—	—	60
<i>Palaeorhiza</i>	—	++	+	+	—	—	++N	—	—	50
<i>Heterorhiza</i>	—	+	—	—	—	—	+N	—	—	8
<i>Xenorhiza</i>	—	+	—	—	—	—	—	—	—	1
<i>Anchirhiza</i>	—	—	—	—	—	—	+E	—	—	1
<i>Hemirhiza</i>	—	—	—	—	—	—	+E	—	—	2
<i>Amphylaenus</i>	—	—	—	—	—	—	—	—	—	8
<i>Agogenohylaenus</i>	—	—	—	—	—	—	+E	—	—	5
<i>Amphylaenus, s. str.</i>	—	—	—	—	—	—	+E	—	—	3
<i>Meroglossa</i>	—	—	—	—	—	—	++	—	—	28
<i>Hyleoides</i>	—	—	—	—	—	—	+	—	—	10
HALICTIDAE										515
Nomiinae										118
<i>Nomia</i>										118
<i>Steganomus</i>	+	—	—	—	—	—	—	—	—	—
<i>Curvinomia</i>	+	?	—	—	—	—	+EN	—	—	7
<i>Hoplonomia</i>	+	+	+	—	—	—	+EN	—	—	11
<i>Austronomia</i>	?	+	+	—	+	—	+++	—	—	68
<i>Rhopalomelissa</i>	+	+	+	—	—	—	+EN	—	—	8
<i>Reepenia</i>	—	++	—	—	—	—	+N	—	—	11
<i>Ptilonomia</i>	—	+	—	—	—	—	—	—	—	1
<i>Mellitidia</i>	—	++	—	—	—	—	+N	—	—	12
Halictinae										398
<i>Lasioglossum</i>										276
<i>Australictus</i>	—	—	—	—	—	—	+	+	—	11
<i>Parasphecodes</i>	—	+	—	—	—	—	+++	++	—	99
<i>Pseudochilalictus</i>	—	—	—	—	—	—	+E	—	—	1
<i>Callalictus</i>	—	—	—	—	—	—	+E	—	—	8
<i>Austrevylaenus</i>	—	—	—	—	—	—	+	—	+	9
<i>Lasioglossum, s. str.</i>	+	+	—	—	—	—	+	+	—	16
<i>Glossalictus</i>	—	—	—	—	—	—	+W	—	—	1
<i>Nesohalictus</i>	+	+	—	—	—	—	—	—	—	1
<i>Chilalictus</i>	—	—	—	—	+	—	++++	++	—	130
<i>Evylaenus</i>	+	—	—	—	—	—	—	—	—	—
<i>Homalictus</i>	+	++	+	+	+	+	+++	+	—	113
<i>Echthralictus</i>	—	—	—	—	—	+	—	—	—	3
<i>Thrinchostoma</i>	+	—	—	—	—	—	—	—	—	—
<i>Sphecodes</i>	+	+	—	—	—	—	+EN ₂	—	—	4
<i>Nomioides</i>	+	?	—	—	—	—	+N ₂	—	—	2
MELITTIDAE										2
Ctenoplectrinae										2
<i>Ctenoplectra</i>	+	+	—	—	—	—	+N	—	—	2

TABLE 2—(Continued)

Taxa	Java	New Guinea	Solo-mon Is-lands	New Heb-rides	New Cale-donia	Fiji-Tahiti	Australia	Tas-mania	New Zea-land	Names
<i>Allodapula</i>	+	+	+	—	—	—	+N ₂	—	—	14
<i>Exoneura</i>										67
<i>Exoneurella</i>	—	—	—	—	—	—	+E	—	—	1
<i>Brevineura</i>	—	—	—	—	—	—	++E	—	—	26
<i>Exoneura, s. str.</i>	—	—	—	—	—	—	++	+	—	40
<i>Inquilinia</i>	—	—	—	—	—	—	+E	—	—	4
Xylocopini										42
<i>Lestis</i>	—	—	—	—	—	—	+E	—	—	7
<i>Xylocopa</i>										35
<i>Koptortosoma</i>	+	+	—	—	—	—	+N ₂	—	—	35
<i>Biluna</i>	+	—	—	—	—	—	—	—	—	—
<i>Zonohirsuta</i>	+	—	—	—	—	—	—	—	—	—
<i>Platynopoda</i>	+	—	—	—	—	—	—	—	—	—
<i>Hoplitocopa</i>	Lesser Sundas	—	—	—	—	—	—	—	—	—
<i>Cyaneoderes</i>	+	—	—	—	—	—	—	—	—	—
<i>Cyphoxylocopa</i>	Lesser Sundas	—	—	—	—	—	—	—	—	—
<i>Lieftinckella</i>	Celebes	—	—	—	—	—	—	—	—	—
APIDAE										33
Bombinae										4
<i>Bombus</i>	+	—	—	—	—	—	—	—	I	4
Apinae										29
Meliponini										27
<i>Trigona</i>										27
<i>Plebeia</i>	—	+	—	—	—	—	+N ₂	—	—	9
<i>Tetragona</i>	+	+	+	—	—	—	+N ₂	—	—	18
<i>Lepidotrigona</i>	+	—	—	—	—	—	—	—	—	—
Apini										2
<i>Apis</i>										2
<i>Megapis</i>	+	?Kai	—	—	—	—	—	—	—	—
<i>Micrapis</i>	+	—	—	—	—	—	—	—	—	—
<i>Apis</i>	+	I	I	I	I	I	I	I	I	2
TOTAL NUMBER OF NAMES										1920

Australia column of table 2, most groups of which do not even reach New Guinea, meets in northern Australia a relatively small, widespread or paleotropical element (*Sphecodes*, *Nomioides*, *Ctenoplectra*, *Callomegachile*, *Chelostomoda*, *Creightonella*, *Pycnanthidium*, *Nomada*, *Ceratina*, *Xylocopa*).

Good (1957) has emphasized the importance of Torres Strait between Australia and New Guinea in plant geography and considered this strait as the most striking phytoge-

ographic barrier in the world. He indicates that the basic Indo-Malayan type of vegetation reaches New Guinea and extends in progressively more depauperate forms east and southeast through the Pacific islands all the way to New Zealand. By contrast, he regards the Australian flora as extremely different. That the typical Australian flora is utterly different from that of the forests of New Guinea is obvious. However, the dividing line between the two vegetational

types is not Torres Strait but an ecological line that separates the rain forest from eucalyptus forest and savanna. One would hardly expect the strait to be a major barrier because New Guinea is essentially a part of the Australian continent, having been broadly connected with it in the recent past (see Darlington, 1957). Even now Torres Strait is shallow and full of islets and reefs. *Eucalyptus* forest and savanna (often with *Melaleuca* and other trees) are characteristic of much of Australia (trees being absent only from the driest areas). However, along the Great Dividing Range and in places along the coast, from the Cape York Peninsula into New South Wales, are patches of rain forest (lacking *Eucalyptus* and its allies) similar to that of New Guinea. These forests consist of a multitude of kinds of trees, interlaced with epiphytes and lianas, and the more southern ones are the southernmost rain forests of tropical type in the world. Forests similar to those of the moister parts of the Oriental faunal region occupy most of New Guinea. However, along the southern coast of New Guinea and even on the island of Misool are substantial areas of *Eucalyptus* or *Melaleuca* savanna. Although areas exist in Australia where mixed types of vegetation occur, usually both in Australia and New Guinea the line between *Eucalyptus* forest or savanna and the Indo-Malayan rain forest is extremely sharp. Often in a distance of 2 meters one can pass from one to the other. It is this line that forms the boundary between the strikingly different floras. Such a floral line cannot fail to have an important influence on the distribution of insects. Readers desiring further biogeographical information on Australia are referred to Keast, Crocker, and Christian (1959), Burbidge (1959), and Anonymous (1960).

Since few bees live in virgin rain forest, the exact position of the rain-forest margin is less important for bees than for some insects. Even in New Guinea most bees are found in clearings, along forest margins, and in openings in the forest. Therefore it is not surprising that bee distribution does not correspond perfectly to the floral line described above. However, various groups of bees (e.g., *Palaeorhiza*, *Mellitidia*, *Reepenia*) do exhibit in Australia a distribution limited to areas more

or less near the tropical rain-forest patches. The ineffectiveness of Torres Strait as a distributional barrier is shown by the fact that, of 40 groups of bees known from the mainland of New Guinea, only six fail to reach Australia.

On the other hand most Australian groups do not reach New Guinea. Perhaps this failure is partly due to the poor collecting in the savanna areas of the southern coast of New Guinea, especially in those near Cape York where the Australian type of vegetation is best developed. However, many typical Australian groups (e.g., *Exoneura*, *Euryglossidia*, *Trichocolletes*, *Euhesma*) are unknown in the similar savannas of northern Australia. Presumably their failure to reach northern Australia and New Guinea results from ecological factors and not from the barrier of Torres Strait.

THE INSULAR BEE FAUNAS

Outside Australia, within our area, the main characteristics of the insular bee faunas are as follows:

Tasmania has a fauna like that of southeastern Australia but, if the collecting has been at all adequate, quite depauperate (table 2). No genus, subgenus, or species group is restricted to Tasmania or represented there by any unusual number of species.

Lord Howe Island has one, probably endemic, species of *Leioproctus*; its other bees (a *Hyleoides* and a *Hackeriapis*) are Australian species probably introduced by man.

New Zealand contains an exceedingly depauperate bee fauna: one endemic subgenus and three other groups found also in Australia (table 2). None contains many species; when synonymy is considered, there may be fewer than 20 native species. One New Zealand species reaches the Chatham Islands.

The oceanic islands from Fiji eastward contain but few bees. Fiji, Tonga, and Samoa are inhabited by a few species of *Homalictus*, and in Samoa is found the interesting endemic parasitic genus *Echthralictus*. These islands, as well as the low islands to the northward (Ellice and Phoenix groups), are inhabited also by a few species of *Lithurge* and *Eutricharaea*, which because of their nesting habits have possibly been carried from island to island by man. A most interesting finding is a species of *Prosopistemon*, a principally Aus-

TABLE 3
DISTRIBUTION OF THE GROUPS OF BEES IN WALLACEA AND ADJACENT REGIONS

Taxa	Java	Celebes	Timor	Buru	Seram, Ambon	North Moluccas	New Guinea	Bismarck Archipelago
COLLETIDAE								
<i>Leioproctus</i> , s. str.	—	—	—	—	—	—	+	—
<i>Prosopistemon</i>	—	—	—	—	—	—	+	—
<i>Gephyrophylaeus</i>	?	?	—	—	—	—	+	—
<i>Palaeorhiza</i> , s. str.	—	—	+	+	+	—	++	+
<i>Heterorhiza</i>	—	—	—	—	—	+	+	—
<i>Xenorhiza</i>	—	—	—	—	—	—	+	—
HALICTIDAE								
<i>Curvinomia</i>	+	—	—	+	—	+	?	—
<i>Hoplonomia</i>	+	+	+	+	+	+	+	+
<i>Steganomus</i>	+	—	—	—	—	—	—	—
<i>Austronomia</i>	?	—	—	—	—	—	+	+
<i>Rhopalomelissa</i>	+	+	—	+	—	+	+	—
<i>Reepenia</i>	—	—	—	—	—	—	++	+
<i>Ptilonomia</i>	—	—	—	—	—	—	+	—
<i>Mellitidia</i>	—	—	—	+	+	—	++	+
<i>Parasphcodes</i>	—	—	—	—	—	—	+	—
<i>Lasioglossum</i> , s. str.	+	—	—	+	+	—	+	—
<i>Nesohalictus</i>	+	—	—	—	—	—	+	—
<i>Evyllaes</i>	+	—	—	—	—	—	—	—
<i>Homalictus</i>	+	—	—	+	—	—	+	+
<i>Thrinchostoma</i>	+	—	—	—	—	—	—	—
<i>Sphcodes</i>	+	—	—	—	+	—	+	+
MELITTIDAE								
<i>Ctenoplectra</i>	+	—	—	—	+	—	+	—
MEGACHILIDAE								
<i>Lithurge</i>	+	—	—	+	—	—	+	+
<i>Callomegachile</i>	+	+	+	+	+	+	+	+
<i>Eumegachilana</i>	+	—	—	+	—	+	+	+
<i>Hackeriapis</i>	—	—	—	—	—	—	+	—
<i>Chelostomoda</i>	+	—	—	—	+	—	+	—
<i>Creightonella</i>	+	+	+	+	+	+	+	+
<i>Eutricharaea</i>	+	+	—	+	+	—	+	+
<i>Callochile</i>	+	+	—	+	+	+	+	+
<i>Heriades</i>	+	—	—	—	—	—	—	—
<i>Coelioxys</i>	+	+	—	+	—	+	+	—
<i>Liothyrapis</i>	+	—	—	—	—	—	+	—
<i>Pycnanthidium</i>	+	—	—	—	—	—	+	—
<i>Parevaspis</i>	+	—	—	+	—	+	Kai	—
ANTHOPHORIDAE								
<i>Nomada</i>	+	—	+	—	+	—	+	+
<i>Amegilla</i>	+	+	+	+	+	—	+	+
<i>Asaropoda</i>	—	—	—	—	—	—	+	—
<i>Habropoda</i>	+	—	—	—	—	—	—	—
<i>Callomelecta</i>	+	—	—	—	—	—	—	—
<i>Thyreus</i>	+	+	+	+	+	+	+	+
<i>Ceratina</i> , s. str.	+	—	—	—	—	—	+	—
<i>Ceratinidia</i>	+	—	—	+	—	—	+	—
<i>Pithitis</i>	+	+	—	—	+	—	—	—
<i>Allodopula</i>	+	—	—	—	—	—	+	—
<i>Koptortosoma</i>	+	+	+	+	+	+	+	+

TABLE 3—(Continued)

Taxa	Java	Celebes	Timor	Buru	Seram, Ambon	North Moluccas	New Guinea	Bismarck Archipelago
<i>Biluna</i>	+	+	—	—	—	—	—	—
<i>Zonohirsuta</i>	+	+	—	—	—	—	—	—
<i>Platynopoda</i>	+	—	+	—	—	—	—	—
<i>Hoplitocopa</i>	Lesser Sundas	—	—	—	—	—	—	—
<i>Cyaneoderes</i>	+	—	—	—	—	—	—	—
<i>Cyphoxylcopa</i>	Lesser Sundas	—	—	—	—	—	—	—
<i>Lieftinckella</i>	Celebes	—	—	—	—	—	—	—
APIDAE								
<i>Bombus</i>	+	—	—	—	—	—	—	—
<i>Plebeia</i>	—	—	—	—	—	—	+	—
<i>Tetragona</i>	+	+	+	+	+	+	+	+
<i>Lepidotrigona</i>	+	—	—	—	—	—	—	—
<i>Megapis</i>	+	+	+	—	—	—	?Kai	—
<i>Micrapis</i>	+	—	—	—	—	—	—	—
<i>Apis</i>	+	+	?	I ^a	I	I	I	I

* I means introduced.

tralian subgenus, in the Tuamotu Archipelago, east of Tahiti and off the map (fig. 1). Otherwise members of this subgenus are unknown east of the Chatham Islands.

The bee fauna of New Caledonia is little known, but it contains both Australian elements (*Nodocolletes*, *Chilalictus*, and *Austronomia*) and Indo-Malayan elements (*Callo-megachile*) (see table 2).

The remaining island groups, to the northeast of Australia as far east as the New Hebrides, contain none of the typical Australian elements except for *Leioproctus*, *sensu stricto*, *Prosopistemon*, *Austronomia* (if it can be called typically Australian; in reality it ranges to Asia but is abundant only in Australia), *Hackeriapis*, and *Asaropoda*, all of which occur in New Guinea. Of course the richest of these island faunas is in New Guinea, as shown in tables 2 and 3, the faunas of the Bismarcks, Solomons, and New Hebrides becoming progressively poorer.

As various authors (e.g., Gressitt, 1959, 1961) have pointed out, the Papuan insect fauna, like its flora, is Oriental and not Australian in most of its affinities. In tables 2 and 3, Java has been included as the nearest area having a more or less complete Oriental fauna. The tables show clearly that most of the groups that occur in Java also reach New

Guinea. *Steganomus*, *Erylaeus*, *Thrinchostoma*, *Parevaspis*, *Heriades*, *Callomelecta*, *Habropoda*, *Pithitis*, seven subgenera of *Xylcopa*, *Bombus*, *Lepidotrigona*, and three subgenera of *Apis* (in all, 20 groups) occur in Java or east of Java in the Lesser Sundas or in Celebes but not in New Guinea. Four basically Australian groups plus the Papuan elements described below, in all 12 groups, occur in New Guinea but not Java.

A small but distinctive Papuan element is centered in New Guinea but ranges to the Moluccas, Flores, Timor, the Bismarcks, the Solomon Islands, the New Hebrides, and northern Australia. The only genus having such a broad distribution is *Palaeorhiza*. To this may be added *Reepenina*, *Ptilonomia*, and *Mellitidia*, which range less widely. *Palaeorhiza* has its close relatives among the hyaline bees of Australia; the affinities of the three subgenera of *Nomia* are not known except that they seem to be rather similar to one another. Of these groups, only *Palaeorhiza* has undergone considerable radiation; it is represented by several subgenera and many species.

Although I have not had personal experience in the Oriental faunal region except for New Guinea, my impression is that bees are relatively scarce throughout the whole Indo-

Malayan area. *Apis* reaches its maximum abundance and diversity in that area, as do a few subgenera of *Trigona*, *Xylocopa*, and of the Megachilidae, and there a few subgenera of these groups limited to the Indo-Malayan area. By and large, however, there is a single paleotropical bee fauna, richest in Africa, poorer in tropical India and southeast Asia, still poorer and progressively so through Indonesia¹ to New Guinea, and fading out gradually farther eastward across the Pacific. I do not know why the Oriental Region should have the poorest tropical bee fauna in the world; possibly the dominance of *Apis* is involved.

Since, as noted above, the Australian contribution to the bee fauna of the eastern part of the Oriental faunal region (New Guinea) has been surprisingly small, New Guinea has, for an area of such great ecological diversity (savanna and rain forest, sea level to over 16,000 feet altitude), a meager bee fauna. The stingless bees (*Trigona*) illustrate this point. In all New Guinea only about nine species are known, yet within a few miles of Belém, at the mouth of the Amazon, in an area of negligible topographic and ecologic diversity, about 40 species exist. Tables 2 and 3 show 40 groups (genera and subgenera) of bees in New Guinea, compared to 127 groups in Australia.

The paucity of known bees in New Guinea is in part due to poor collecting; many new species, especially of *Palaeorhiza*, will be found and certainly some additional Australian groups probably reach the savanna areas of the southern coast. Personal experience convinces me, however, that bees are relatively scarce there, compared to the American tropics or indeed to almost any other temperate or tropical part of the world.

Table 3 is designed to show what little we know about the bee faunas of some of the islands between Java and New Guinea. In examining this table, one should remember that almost all the Javan groups also range westward into Asia, while, as already stated, all but six of those in New Guinea also reach

Australia. Of course the small areas of some of the islands would support only limited faunas; moreover, apparent deficiencies may result from poor collecting.

HISTORY

It was pointed out some time ago (Michener, 1944) that the Australian bee fauna consists for the most part of ground-nesting members of the two families that on morphological bases were considered most primitive (Colletidae and Halictidae), together with members of other groups that contain forms that nest in wood or twigs. This situation was explained by the assumptions (1) that the Colletidae and Halictidae reached Australia probably in late Cretaceous times when other terrestrial forms reached Australia from Asia, (2) that this time was sufficiently early in apoid evolution that the more specialized families had not arisen and hence could not follow the same land route, and (3) that members of more specialized groups which nest in wood or twigs (e.g., Megachilidae, Xylocopinae, Meliponini, and others) had a better chance to reach Australia by "island hopping" than ground-nesting groups because of the possibilities of rafting. (Not all Australian megachilids nest in wood, but those that do not may have arisen from rafting ancestors that did.)

Knowing more now about bee distribution than in 1944, I only partly agree with the above explanations. The early arrival of primitive forms and failure of others to reach Australia at the same time (items 1 and 2 in the above paragraph) seem probable for the Colletidae in view of the remarkable radiation of that family in Australia. The Halictidae may well have arrived later in view of (a) their demonstrated ability to cross water barriers (they range as far east as Samoa) and (b) their relatively minor radiation (only at the subgenus and species levels, but many species) in Australia. Item 3 in the above paragraph now seems to me not demonstrable. The bee fauna of the Oriental Region, as already explained, is peculiarly poor compared to other major faunal areas, and many of the ground-nesting forms that in 1944 seemed to me to be excluded from Australia by the water barriers do not extend much into the Oriental Region, even where it is in direct

¹ Indonesia is used throughout to mean Indonesia west of Weber's line. The islands to the eastward (the Moluccas, and the recent additions to Indonesia such as Misool and western New Guinea) are treated separately.

contact with the Palearctic. The water barriers, therefore, do not now seem to be the limiting factors in the distribution of such forms. Were they differentially effective, limiting the distribution of burrowing bees more than of those nesting in wood or stems, one would expect to find a considerable number of Asiatic ground-nesting forms that reach Java (now an island, but occupied by a rather typical Oriental fauna) but do not reach New Guinea and Australia. However, of the 20 genera and subgenera that reach Java or occur in islands east of it but do not exist in New Guinea, only five are probably ground-inhabiting bees (*Steganomus*, *Evylaeus*, *Thrinchostoma*, *Habropoda*, and *Callomelecta*). The rest presumably nest in wood or twigs.

The typically Australian elements (*Stenotritinae*, *Euryglossinae*, *Exoneura*, the Australian genera and subgenera of *Paracolletini* and *Hylaeninae*, and the Australian subgenera of genera such as *Lasioglossum* and *Chalicodoma*) constitute most of the abundant bees of the temperate parts of Australia. These groups are found in no other continents. Some of the groups (e.g., *Exoneura*, *Chilalictus*) have obvious relations to Asiatic or Afro-Asiatic forms and presumably arose from ancestors that reached Australia from the north. Some (*Stenotritinae*, *Euryglossinae*) are found only in Australia and probably arose there although they could be relicts of formerly more widespread groups. The tribe *Paracolletini* is the only group of bees having a panaustral distribution. It is best represented in Australia but occurs also in New Zealand, South America, and in South Africa. The single genus *Leioproctus* occurs in all these places except perhaps Africa. In 1944 I made a list of 36 characters that I thought to be primitive among bees and was then surprised to discover that certain *Paracolletini* possessed all of them. Clearly they are very primitive bees. Their disjunct southern distribution can be explained either as the remnants of a once wide and partly northern distribution or as a result of the crossing of the southern oceans at a time when water gaps were narrower than they are at present. The presence of species of this tribe on New Caledonia, Lord Howe Island, and New Zealand suggests considerable ability to cross substantial water gaps.

Two groups of bees (*Homalictus*, *Austro-nomia*) are abundant and diversified in Australia but range widely to the north and west, even into Asia. These may represent basically Australian forms that have spread, or Asiatic forms that reached and radiated widely in Australia. The former explanation seems more likely, since neither group reaches Africa or Europe.

In addition to the typical Australian faunal elements there exist some widespread groups in that continent that are nonetheless representatives of genera or subgenera that are larger and more diversified in Asia and Africa, or elsewhere. Quite possibly these groups arrived in Australia after most of the typical Australian elements. The groups concerned are *Lasioglossum*, *sensu stricto*, *Eutricharaea*, *Amegilla*, *Thyreus*, *Coelioxys*, *Allodapula*, and *Tetragona*. *Hackeriapis* is remarkable in that it is abundant in Australia, without close relatives elsewhere in the Old World, but exceedingly close to *Chelostomoides* of the New World.

Presumably more recent arrivals from the Oriental faunal region include genera and subgenera such as *Sphecodes*, *Nomioides*, *Ctenoplectra*, *Callomegachile*, *Chelostomoda*, *Creightonella*, *Pycnanthidium*, *Nomada*, *Ceratina*, and *Xylocopa* which have undergone little speciation in Australia, are limited to the northern or northeastern parts of the continent, and differ little from species found in Indonesia or southern Asia.

Just as the *Paracolletini* (especially *Leioproctus*) are the only bees having a panaustral distribution, the stingless honeybees (*Trigona*) are the only ones having a pantropical distribution. The subgenus *Tetragona* is found in all major tropical areas except Africa, and the subgenus *Plebeia* is found in all major tropical areas except the one of Asia. The species of *Plebeia* found in the northern half of Australia and in New Guinea are, therefore, widely separated from their relatives in Africa and the American tropics. The *Tetragona* of our area are very similar to those of Indonesia and tropical Asia, while the *Plebeia* are quite different from those found anywhere else in the world and may be a relict group, as is suggested by their possibly primitive biological characteristics (see Michener, 1961c).

The reason that *Trigona* has been able to get from continent to continent across the tropics while other bees have not (except possibly for widespread groups that also occur in cool climates) is most likely that the nests of stingless bees, in hollow logs and trees, sometimes even in rather small branches of trees, have occasionally been carried across

the tropical oceans in natural rafts or even in emergent parts of floating logs. Their well-stored nests would make such a passage possible, as a rare event, while other kinds of bees could never cross such large bodies of water. At least there is no evidence that other bees have done so. (A largely contrary view has been elaborated by Kerr and Maule, 1964.)

FLOWER RELATIONSHIPS OF AUSTRALIAN BEES

Bees are dependent on nectar from flowers as their chief source of carbohydrates and on pollen as their source of proteins. Many species of bees obtain nectar from a wide variety of flowers, and some also gather pollen from many kinds of flowers. However, some bees are restricted in their pollen collecting to certain kinds of flowers. Since most of the pollen that is gathered is used in provisioning cells with food for larvae, an activity in which only the females engage, it is primarily the females that show the restriction in their flower visits to certain kinds of flowers. Males, and females gathering only nectar, often visit the same flowers but may also visit other kinds of flowers. Bees that gather pollen from a wide variety of flowers are called polylectic; those that gather from only a few species of related flowers are called oligolectic. (For discussion, see Linsley, 1958.) Unfortunately the numerous colletids of the subfamilies Hylaeinae and Euryglossinae carry pollen with the nectar in the crop instead of among scopal hairs on the legs and body. For such bees it is therefore not easy to determine the degree of oligolecty, since one never knows whether a female is gathering pollen or merely sucking nectar.

Australia is the only continent where most of the species of bees seem to be largely dependent on a single family of plants. This family, the Myrtaceae, is the dominant one of shrubs and trees in most of Australia. Genera that are attractive to bees include *Angophora*, *Baeckea*, *Callistemon*, *Eucalyptus* (500 to 700 species), *Eugenia*, *Leptospermum*, *Melaleuca*, and *Tristania*. Except for the patches of tropical rain forest, the driest deserts, and the cities and fields denuded by man, few places in Australia are out of sight of members of these genera. They flower profusely, although in many areas erratically as to season. Their apicultural importance is

shown by the fact that a list of the honey sources of southeastern Queensland contains 47 species of Myrtaceae, 10 introduced weeds and crops, and only 17 species of native plants in all other families together (Blake and Roff, 1958).

My collecting of wild bees in central and southern Queensland, south to the New England area of New South Wales (July, 1958, to June, 1959), resulted in collections from 76 species of plants which seemed important enough to record. The number of collections from each plant is shown after the name in the list below. The importance of the Myrtaceae is obvious, for 29 species of this family are on the list compared to 43 native species of all other families together. However, if one considers the number of species and of individuals of bees, the preponderance of the Myrtaceae as food sources for Australian bees becomes overwhelming. Although the Leguminosae seem rather high in numbers of plant species and collections, the number of species and individuals of bees in most collections from that family was small.

PLANTS ON WHICH NATIVE BEES WERE COLLECTED

Xanthorrhoeaceae

Xanthorrhoea 2

Proteaceae

Banksia 1

Lomatia silaifolia 1

Persoonia lanceolata 1

Persoonia virgata 2

Nymphaeaceae

Nymphaea capensis 1 (introduced)

Cruciferae

Rapistrum rugosum 1 (introduced)

Pittosporaceae

Bursaria spinosa 1

Rosaceae

Rubus rosaefolius 1

Leguminosae

Aotus lanigera 3*Cassia circinata* 1*Cassia occidentalis* var. *schinifolia* 1*Daviesia corymbosa* 1*Daviesia latifolia* 1*Daviesia squarrosa* 2*Daviesia umbellulata* 4*Dillwynia peduncularis* 1*Jacksonia scoparia* 10*Mirbelia* sp. near *aotoides* 1*Oxylobium ilicifolium* 1*Pongamia pinnata* 1*Pultenaea* sp. 3*Pultenaea microphylla* 1*Pultenaea villosa* 5*Swainsona galegifolia* 1

Ericaceae

Leucopogon margarodes 1

Rutaceae

Boronia rosmarinifolia 1*Boronia granitica* 1

Euphorbiaceae

Claxoxylon australe 1

Rhamnaceae

Alphitonia excelsa 1

Malvaceae

Hibiscus sp. 1

Dilleniaceae

Hibbertia linearis 10

Myrtaceae

Angophora costata 1*Angophora intermedia* 1*Angophora subvelutina* 1*Angophora woodsiana* 2*Baeckea* sp. 1*Callistemon* spp. 1*Callistemon salignus* 2*Callistemon viminalis* 1*Calytrix tetragona* 1*Eucalyptus* sp. 2*Eucalyptus crebra* 1*Eucalyptus intermedia* 2*Eucalyptus melanophloea* 1*Eucalyptus tereticornis* 3*Eucalyptus tessellaris* 3*Eugenia ventenatii* 1*Leptospermum* sp. 3*Leptospermum attenuatum* 1*Leptospermum brachyandrum* 1*Leptospermum flavescens* 7*Leptospermum luehmannii* 1*Leptospermum microcarpum* 1*Melaleuca* spp. 1*Melaleuca bracteata* 2*Melaleuca irbyana* 1*Melaleuca lineariifolia* 2*Melaleuca nodosa* 1*Melaleuca sieberi* 3*Tristania suaveolens* 2

Melastomaceae

Melastoma polyanthum 1

Solanaceae

Solanum furfuraceum 2

Goodeniaceae

Goodenia paniculata 1*Velleia spathulata* 3

Campanulaceae

Wahlenbergia sp. 10*Wahlenbergia ?sieberi* 2*Wahlenbergia ?bicolor* 1

Compositae

Ageratum houstonianum 2 (introduced)*Erigeron floribundus* 2 (introduced)*Helichrysum* sp. near *apiculatum* 1*Helichrysum bracteatum* 1*Helipterum anthemoides* 1*Hypochaeris radicata* 2*Leptorhynchus squamatus* 1*Podolepis neglecta* 1

The large genera of non-myrtaceous Australian flowering shrubs and trees (*Acacia* in the Mimosaceae and *Grevillea* in the Proteaceae) seem to be of little importance from the standpoint of native bees.

Each flower of most species of Myrtaceae exposes the nectar in a broad shallow cup from which it can readily be sucked without the aid of a long tongue. Indeed, when one strikes a cluster of flowers with a net the nectar often spatters out onto the net and into one's face.

Native bees are often present in enormous profusion about the flowers of Myrtaceae, especially the genera *Eucalyptus* and *Angophora*. Sometimes the smaller bees such as

the minute species of *Euryglossina* and *Euryglossula* appear as a shimmering cloud around the flowers. To the exasperation of the bee collector, most such trees have their flowers high up, where even a long net cannot reach.

Possibly partly because so much of the flowering of *Eucalyptus* and *Angophora* is not a regular annual phenomenon but is erratic, depending on weather and other conditions, or occurs only once in several years, bees do not seem to be restricted to particular species of Myrtaceae. Instead, a great many species seem to be oligolectic visitors of Myrtaceae in general, but they will collect pollen from whatever Myrtaceae are in bloom at the moment. Of course more detailed collecting may show the existence of narrower oligolecty among forms visiting Myrtaceae, but I obtained no evidence for it in a single year of work in Australia. The few species collected so far from only a single genus of Myrtaceae will probably be found to utilize others when more collecting is done.

The bulk of the typically Australian elements in the bee fauna (e.g., colletids, halictids, megachilids of the *Hackeriapis* group) are oligolectic on or at least frequently visit Myrtaceae. Most of these are short-tongued bees which must find it particularly easy to obtain nectar from flowers constructed like those of the Myrtaceae. Probably the dominance of the Colletidae in Australia is possible only because of the abundance of Myrtaceae, or perhaps the plants and bees evolved together so that the abundance of each would be impossible without the other.

Certain other pollinators must also play a role in the success of the plants that are so important as food sources for bees. There are large numbers of vertebrate pollinators of *Eucalyptus* and its allies. The principal groups involved are the brush-tongued parrots or lorikeets (*Trichoglossus* and allies), the large family of honeyeaters (Meliphagidae) with 68 Australian species, and the flying foxes or fruit bats (*Pteropus*). All of these are abundant forms which, in Australia at least, feed largely on nectar of *Eucalyptus* and its allies. Colonies of tens of thousands of flying foxes occur; like the flower-feeding birds, they move about with the flowering of the trees. (Although called "fruit bats," they rarely damage fruit in Australia, but the same spe-

cies in New Guinea where *Eucalyptus* is limited in distribution are pests of fruits.) None of these vertebrate pollinators has a long, slender tongue and beak like most hummingbirds. All get their faces well into the flowers, among the stamens, to get nectar. Probably the various species of *Eucalyptus* with large flowers and long stamens are adapted to such pollinators, although the vertebrates also visit smaller-flowered *Eucalyptus*. Bees visit the large flowers freely, although they are presumably completely ineffective as pollinators of them. The smaller bees clamber about among the stamens gathering pollen, apparently never coming near the stigmatic surfaces.

For a list of species that are probably oligolectic on Myrtaceae, it must be remembered that the dominance of the family is so great that conclusions are often doubtful. Sometimes the only flowers in a given area at a given season that are attractive to bees of any kind belong to the Myrtaceae. In this case repeated captures of a species on flowers of that family prove little about oligolecty. However, it seems likely that the species listed below are among those more or less restricted to Myrtaceae: *Leioproctus semipurpureus*, *L. ornatissimus*, *Lasioglossum vitripenne*, and *Homalictus dampieri*. I have one record of the last species collecting pollen on yellow Compositae.

The almost complete restriction of the many *Euryglossinae* that I studied to Myrtaceae (except for species restricted to *Wahlenbergia*) is obvious from the numerous flower records listed in Appendix 1. The *Hylaeinae*, again except for those associated with *Wahlenbergia*, were also found predominantly on Myrtaceae. If the *Hylaeinae* carried pollen externally, it might become evident that the pollen collecting of most species is restricted to this subfamily, as that of the *Euryglossinae* appears to be.

Although the striking fact of the importance of the Myrtaceae overshadows other matters regarding flower relationships of Australian bees, a number of other interesting points should not be ignored. Of course there exist bees that visit a variety of flowers, including the Myrtaceae. This is true of species of *Allodapula*, *Exoneura*, *Nomia*, *Lasioglossum griseovittatum*, *Lestis bombylans*, and

others, above all, *Trigona carbonaria* and the introduced *Apis mellifera*.

Another group of bees visits a wide variety of flowers, including often introduced ones, but is rarely or never seen on Myrtaceae. This group includes *Homalictus urbanus*, *Lasioglossum erythrurum*, *Leioproctus insularis*, and *Amegilla*.

In addition to the categories listed above are the narrowly oligolectic forms, restricted to a single genus or perhaps species of flower for their pollen collecting. The following examples of such behavior were noted: *Cladoce-rapis*, a subgenus of *Leioproctus*, is restricted to flowers of *Persoonia* (Proteaceae). This oligolectic relationship was first noted by Rayment (1950a) and verified by my observations of *Leioproctus bipectinatus*, *incanescens*, and *speculifer*.

Trichocolletes venustus, *marginatulus*, and their relatives collect pollen only from small yellow legumes, principally *Daviesia* but also *Pultenaea*, *Murbelia*, and probably *Aotus* and *Dillwynia*. This relationship was noted by Hacker (1918) and Rayment (1929a, 1935) and was verified by my observations. Some other species seemingly oligolectic or commonly associated with Leguminosae are *Leioproctus truncatulus*, *Lasioglossum orbatum*, *L. idoneum*, *Chalicodoma derelicta*, and *Megachile chrysopyga*.

Several species may be restricted in pollen collecting to yellow Compositae. These include *Leioproctus helichrysi*, *Lasioglossum languinosum*, and *L. imitator*.

An interesting group of species seems to be restricted to the flowers of *Wahlenbergia* (family Campanulaceae). These bluebells

have coarse, pale pollen. The bees are small, dull black, commonly duller and smaller than their relatives. This curious assemblage seems not to have received much attention from previous collectors but was found by me wherever bees were collected on *Wahlenbergia*. The following species appear to be oligolectic on *Wahlenbergia*: *Leioproctus microsomus*, *L. wahlenbergiae*, *Euryglossa wahlenbergiae*, *Hylaeus albocuneatus*, *H. multigibbosus*, *Lasioglossum gynochilum*, *L. obscurissimum*, and *L. wahlenbergiae*.

Leioproctus moretonianus seems to collect pollen only from flowers of Goodeniaceae. To judge largely from other sources, *Lithurge* in our area is restricted in its pollen collecting to *Hibiscus* and possibly other large Malvaceae.

The bees listed above as having certain floral relationships are so placed in many cases on admittedly scanty evidence. The records given in Appendix 1 are factual, but the placement in the groupings above may be erroneous. The judgment in each case was based on a variety of factors, including the number of collections, the abundance of bees on a given flower, the presence of other flowers competing for the bees' attention at the same locations, and the attractiveness of the other flowers to bees in general. In many cases supplementary evidence for placement exists in the form of collections of related unidentified or undescribed bees on the same or related flowers. Such records are not listed in Appendix 1. While further study will probably substantiate the general conclusions outlined above, some species will have to be moved out of one group into another.

PREVIOUS WORK ON BEES OF AUSTRALIA AND THE SOUTH PACIFIC

Unfortunately most work on bees of our area has been purely descriptive, done by foreign entomologists, and based on material sent to them by collectors in Australia or the Pacific islands. The result has been descriptions of enormous numbers of species, many of them examined uncritically so that their real relationships have not been properly made known. Hence in the present work a large number of new genera and generic changes have been necessary.

Cockerell (1930c) has given an account of the history of melittology in Australia. It will suffice here to say that the first Australian bees were described by Fabricius (1775). Since that time various authors have described Australian species, but the major contributions were by Smith (1853, 1854, 1879), Cockerell (numerous papers), and Rayment (numerous papers). The works of Rayment, the only Australian melittologist to publish extensively, have appeared from 1927 almost

to the present time. His largest work, in which he named many new species, appeared in 1935.

Cockerell (1930c, 1930d, 1931a, 1932a, 1933a, and 1934a) gave keys to many Australian bees and notes on many species. These often give useful hints as to the identity of specimens. However, the series of papers is incomplete, for Cockerell omitted the Euryglossinae and Hylaeinae; he had given a key to many species earlier (Cockerell, 1910f).

The island bee fauna, like that of Australia, has become known over a period of many years. Fabricius described insects, including bees, from Ambon, but, as Lieftinck (1959) has pointed out, not all of them actually came from that island. The first author to describe many bees from our island areas was F. Smith who in a series of reports on materials col-

lected by Alfred Russel Wallace described bees from New Guinea, the Kai and Aru islands, the Moluccas, and other areas. The subsequent papers dealing with whole faunas are on the bees of New Guinea (Friese, 1909), of Buru (Alfken, 1926) [with these may be compared Friese's (1914) paper on bees of Java], of the Solomon Islands (Krombein, 1949, 1951), of Fiji (Turner, 1918), of Samoa and Fiji (Perkins and Cheseman, 1928), and of New Zealand (Meyer, 1931).

In addition to lists included in the publications cited above, several faunal lists of bees of various areas have been prepared, e.g., for Australia (including Tasmania) by Hacker (1921), for Tasmania by Cockerell (1913b), and for the Bismarck Archipelago, Solomon Islands, New Caledonia, and intervening groups by Cockerell (1911b).

METHODS AND EXPLANATIONS OF SYMBOLS

As usual in a systematic study, the systematic section of this work begins with a key to the families of bees that occur in our area. The families are then taken up, one by one, and keys are provided for the subfamilies, the tribes, genera, and subgenera. Because the families of bees are often hard to distinguish without examining the mouthparts, which in pinned specimens are frequently folded out of sight, an artificial key is given after the key to families to facilitate rapid identification of bees. All the keys are designed to work for species of our area but do not necessarily function properly for exotic forms. In some tribes and genera, the keys serve more as summaries of characters than for easy identification. This problem (see especially *Leioproctus*) exists because some groups are known in only one sex while other obviously different groups are known only in the other sex. Separate keys could have been given for the two sexes, but it seemed that a more useful summary could be presented in the form of a single key. It is fully appreciated that, as the fauna becomes better known, new and better keys will be needed.

The amount of descriptive material offered in the various sections varies enormously, from virtually none for distinctive, easily

identified types such as *Xylocopa* to fairly extensive descriptions and figures in groups in which the subdivisions are little known, new, or frequently misunderstood. To have followed a consistent policy of rather full descriptions and figures would have greatly increased the size of this work.

Figures divided by a median vertical line show dorsal structures to the left of that line, ventral to the right. In the absence of such a line, the view is dorsal for male genitalia, ventral for male sterna.

While many published names are synonyms, there remain many undescribed species in our area. Some new species are described in Appendix 2. Those selected for description are the ones that are type species of new genera or subgenera, or ones that are so distinctive or unusual that it seemed desirable to refer to them in descriptions of the higher taxa to which they belong, or, in a few cases, ones of special geographical or floral interest. The numerous other new species, mostly more closely related to their named relatives, are left unnamed. It is hoped that others will undertake revisions of the various genera and will obtain and describe the new forms in the process.

An important objective of this work was

to place the named forms, in so far as possible, in proper genera and subgenera. Therefore, under each genus or subgenus, the names are listed. Since specific and subspecific names are coordinate, and since in almost no case has the subspecific status of any form been justified by proper distributional studies and evidence of intergradation, and since published synonymy is subjective and often wrong, all specific and infraspecific names known to have been published are included in these lists. Only objective synonyms resulting from homonymy and the like are shown as synonyms in the lists. The resulting lists are misleading for a few recently revised groups (*Thyreus*, *Xylocopa*, *Ceratina*) but otherwise are adequate.

There remain a few names in some groups that cannot be placed to genus or subgenus at present because the types could not be examined and the descriptions are inadequate. These names are separately listed in appropriate places, in some cases with indications of probable relationships.

In each list the specific names are arranged alphabetically, with the following added information:

1. After each specific name is the name of the author and the date, both included in parentheses if the species was not described in the genus in which it is now placed. If more than one paper by the author of a species is listed in the Literature Cited for the year concerned, a letter following the year indicates the paper in which the species was described.

2. Next appears, in parentheses, the generic name under which the species was described if different from the genus in which the species is now placed. If the species is now in the same genus in which it was originally placed, item 2 is omitted.

3. The abbreviation "n. comb." follows if the name is here placed for the first time in its genus.

4. The next item of information, again in parentheses, is an abbreviation indicating the museum or collection in which the type is preserved (see list below). If followed by an asterisk, I have seen specimens of the species but have not seen the type, although I know of its location from published statements or from correspondence with the curators con-

cerned. If, instead of an abbreviation indicating the location of a type, the abbreviation "desc." appears, I have seen no specimens, do not know the location of the type, and judge the placement of the name from the original description alone or from subsequent published comments or synonymies. The abbreviation "desc." followed by an abbreviation indicating location of the type shows that I have seen no specimens, but that the type is said to be in the collection indicated. Omission of item 4 indicates that I have seen specimens but not type material and do not know where the type is. Occasionally I have not seen the type (=holotype) of a species but have seen other type material. If so, the fact is indicated in the lists. The kind of type, if not specified, is in all cases the holotype. Friese's specimens labeled "*typus*" on orange labels are also noted separately. So far as I know they are usually syntypes, but, since Friese sometimes labeled specimens "*typus*" long after the publication of a description (as shown by specimens so labeled, collected after the species was described), such labels in some cases may mean little more than Friese's identification labels (which are often seriously in error).

5. Finally, if the species is not from Australia or Tasmania, the island from which it was described is indicated. For spellings in the Moluccan area, the "Times Atlas of the World" has been followed; equivalents may appear very different (e.g., Seran, Ceram, Seram; Morty, Moratai; Mysol, Misool), but their identity can usually be recognized phonetically.

A list of abbreviations of museums and collections and their meanings follows:

A.M., Australian Museum, Sydney, New South Wales

A.M.N.H., the American Museum of Natural History, New York

Berlin, Institut für Spezielle Zoologie und Zoologisches Museum der Humboldt Universität, Berlin

Bishop, Bernice P. Bishop Museum, Honolulu, Hawaii

B.M., British Museum (Natural History), London
Burns, N.M.V., A. N. Burns collection, to be deposited in the National Museum of Victoria, Melbourne, Victoria

C.A.S., the California Academy of Sciences, San Francisco

C.S.I.R.O., Commonwealth Scientific and Industrial Research Organization, Canberra
 H.N.M., Magyar Nemzeti Múzeum, Budapest
 H.S.P.A., Hawaiian Sugar Planters Experiment Station, Honolulu
 K.U., Snow Entomological Museum, the University of Kansas, Lawrence, Kansas
 M.A., Zoologisch Museum, Amsterdam
 M.C.G., Museo Civico di Storia Naturale, Genoa
 M.C.Z., Museum of Comparative Zoölogy, Harvard University, Cambridge, Massachusetts
 M.L., Rijksmuseum van Natuurlijke Historie, Leiden
 M.P., Muséum National d'Histoire Naturelle, Paris
 N.M.V., National Museum of Victoria, Melbourne, Victoria
 Ox., Hope Entomological Museum, Oxford Uni-

versity, Oxford
 Q.M., Queensland Museum, Brisbane, Queensland
 S.A.M., South Australian Museum, Adelaide, South Australia
 U.M., Zoological Museum, University of Michigan, Ann Arbor, Michigan
 U.S.N.M., United States National Museum of the Smithsonian Institution, Washington
 W., Naturhistorisches Museum, Vienna
 W. Agric., Western Australian Department of Agriculture, Perth, Western Australia
 W.A.M., Western Australian Museum, Perth, Western Australia
 Wilson, F. E. Wilson, Melbourne, Victoria
 Z.S.M., Zoologische Sammlung des Bayerischen Staats, Munich

MORPHOLOGICAL TERMS

The morphological terminology used in the descriptions and keys is that of Michener (1944), modified in certain ways. The accompanying illustrations show the structures commonly used in taxonomic work, together with the nomenclature here applied to them. Diagrams of the head (figs. 2 to 4) also show the ways in which various measurements, used chiefly in the descriptions in Appendix 2, are made.

Some particulars not shown in the diagrams are as follows: the *malar area* is the space between the eye and the mandible; its length is the shortest distance from the eye to the mandible; the width of this area is the width of the base of the mandible. The *foveae* of the face and of the sides of the second metasomal tergum are shallow depressions, usually black in color, variable in shape from broad to linear. They are not present in the Megachilidae, Anthophoridae, or Apidae but are common among species of the short-tongued families of bees. The foveae in forms of our area are not covered with short hairs as in the chiefly holarctic genus *Andrena*; their condition in that genus has sometimes led to the description of foveae as velvety. The word *orbit* is used for the eye margin, inner orbit for the frontal or facial margin, outer orbit for the genal margin. The *genal area* is the region behind the eye and in front of the preoccipital ridge. The ridge surrounding the concave posterior surface of the head above and laterally is called the *preoccipital ridge*.

In some cases it is carinate; if so, a *preoccipital carina* is present.

The *proboscoidal fossa* is the deep groove on the under side of the head in which the proboscis is folded in repose. The *hypostomal carinae* margin this fossa and at their anterior ends turn laterally toward the bases of the mandibles.

Names of parts of the proboscis and antennae are shown in figures 5 to 9.

Thoracic sclerites and sutures are labeled in figures 10 and 11. The words "scutum" and "scutellum" are used in the place of the more complex mesoscutum and mesoscutellum. The form and subdivisions of the propodeum are not easy to illustrate in such diagrams but are exceedingly important systematically. Many bees (e.g., Paracolletini) have a pair of impressed lines on the propodeum, beginning near the anterior dorsolateral parts of the propodeum and extending downward and posteromesially and nearly meeting in the *propodeal pit*, a median depression of the lower posterior surface. These lines, together with the anterior dorsal margin of the propodeum, enclose the *triangular area* or *propodeal triangle*. The shape of the propodeum as seen in profile is quite independent of the triangle. The whole propodeum may be vertical or nearly so, dropping from the posterior margin of the metanotum. In this case it is termed declivous. However, as in figures 10 and 11, there may be a more or less horizontal basal region. In those figures it is separated

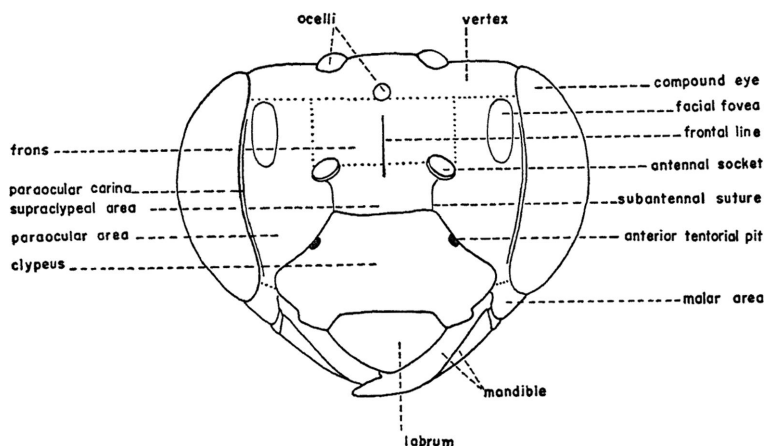


FIG. 2. Diagrammatic front view of the head of a bee, showing major features and names for certain areas outlined by dotted lines.

by a sharp line or carina from the declivous posterior surface. When such is the case, the horizontal part is called the *basal zone* or *basal area* of the propodeum. It is invariably part of the propodeal triangle. The term basal area is applicable even if no sharp line separates the horizontal from the vertical surfaces, but in some bees the two are continuously rounded, one onto the other, in a broad curving surface. In this case the term "basal

area" means little, since it is not definable unless it has a distinctive surface sculpturing.

Wings are illustrated and the veins labeled in figure 12. Because the homologies of these veins are not very certain, as well as because certain comparable veins have very different morphological names (second abscissa of R_s , first r-m and second r-m all are very much alike in appearance), it has seemed best to continue the use of some terms that are morphologically noncommittal for certain cells and veins much used in taxonomy. These terms are shown in figure 13. To save space, the word "stigma" is used in place of pterostigma.

The jugal and vannal lobes of the hind wing are both measured from the wing base to the apices of the lobes. Thus on figures 12 and 13 one might say that the jugal lobe is about two-thirds as long as the vannal.

The *tibial spurs* are the movable inferior apical spurs on the tibiae; the *tibial spines* are immovable, sharp, superior, apical projections, usually small in size, found in some bees (see fig. 14, and Michener, 1944). Description of the tibial spurs is important in many bees; this is especially so of the *inner hind tibial spur*. This spur usually has two toothed margins. It is the inner one that is commonly elaborated in various ways. It may be finely or coarsely serrate. Following custom, I have described this margin as ciliate if it has slender, almost hairlike projections (usually numerous) although in many cases

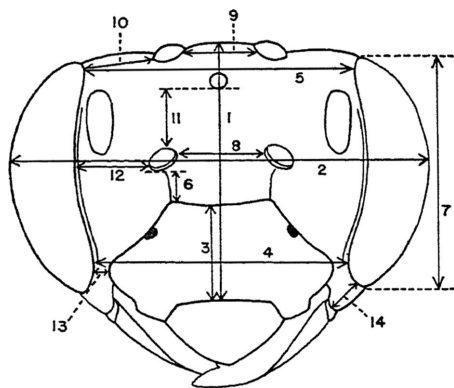


FIG. 3. Diagrammatic front view of head of a bee, showing ways in which certain measurements used in specific descriptions were made: 1, length of head; 2, width of head; 3, clypeal length; 4, lower interorbital distance; 5, upper interorbital distance; 6, clypeo-antennal distance; 7, length of eye; 8, interantennal distance; 9, interocellar distance; 10, ocellocular distance; 11, ocellantennal distance; 12, antennocular distance; 13, clypeocular distance; 14, length of malar space.

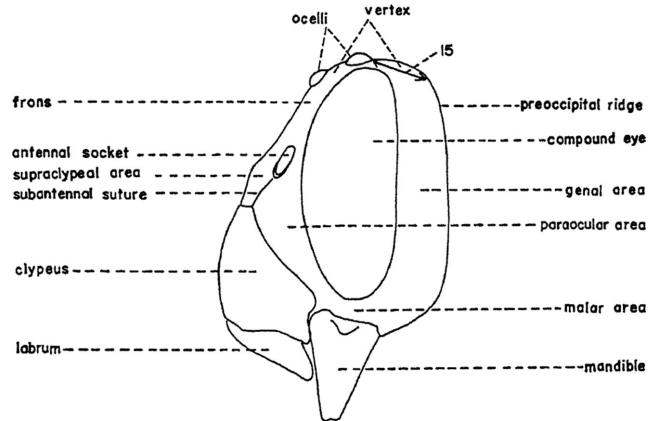


FIG. 4. Diagrammatic side view of head of a bee with a strongly protuberant clypeus, showing major features and the ocelloccipital distance (15). This measurement is made more reliably from above than from the side.

the appearance is like that of a fine comb. Also following custom, I have described as pectinate, spurs in which the inner margin is produced into a few long, coarse, often blunt projections, even though the number of such projections is in some cases reduced to only two or three.

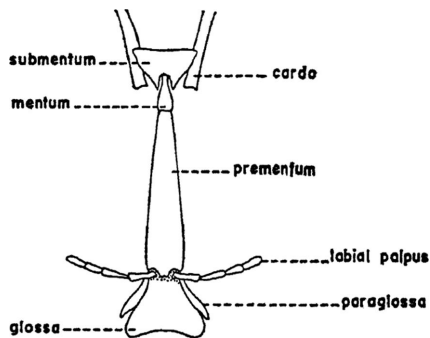


FIG. 5. Diagram of labium and associated maxillary cardines of a colletid bee, seen in ventral or posterior view.

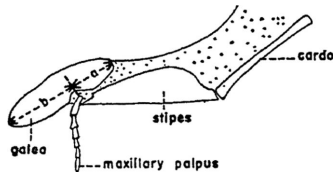


FIG. 6. Diagram of maxilla of a colletid bee. Symbols: a, prepalpal part of galea; b, postpalpal part.

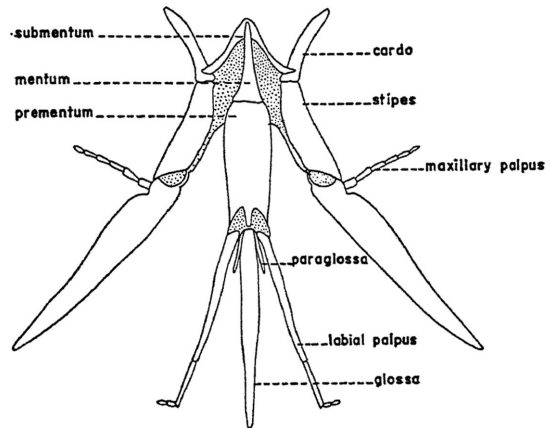


FIG. 7. Diagram of proboscis of an anthophorid bee, seen in ventral or posterior view.

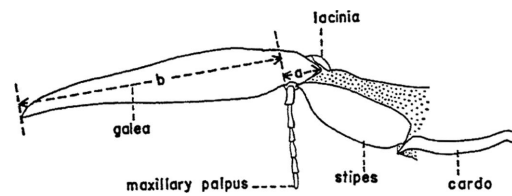


FIG. 8. Maxilla of an anthophorid bee. Symbols: a, prepalpal part of galea; b, postpalpal part.

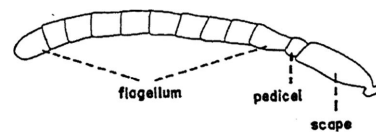


FIG. 9. Diagram of antenna of a female bee.

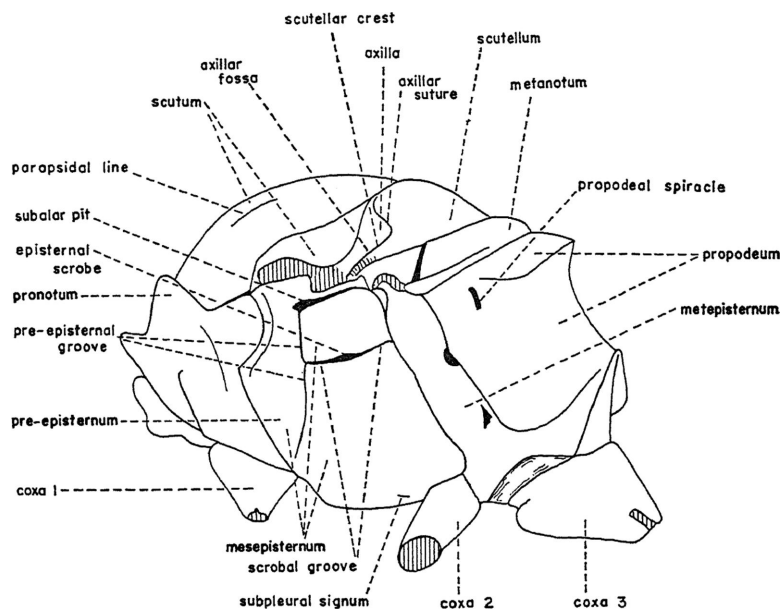


FIG. 10. Diagram of side view of thorax and propodeum (i.e., mesosoma) of a colletid bee.

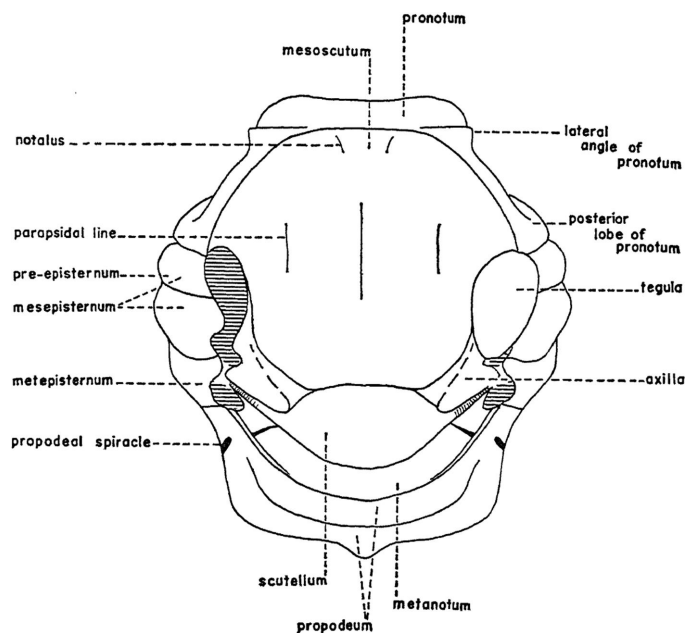


FIG. 11. Diagram of dorsal view of thorax and propodeum (i.e., mesosoma) of a colletid bee.

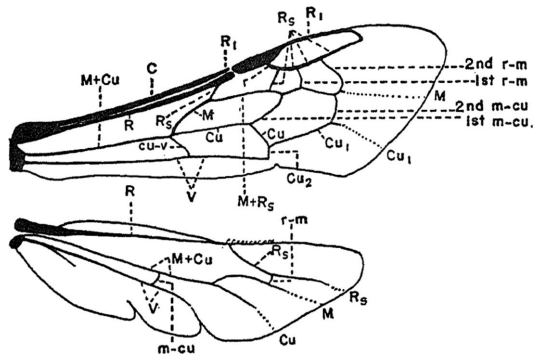


FIG. 12. Diagram of wings of a colletid bee, showing veins (terminology of Michener, 1944, modified from Ross, using the Comstock and Needham system).

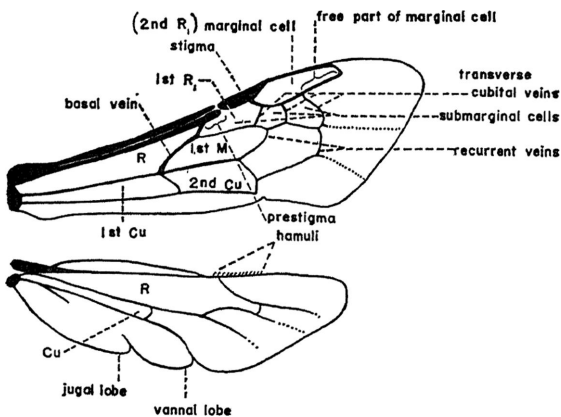


FIG. 13. Diagram of wings of a colletid bee, showing morphologically noncommittal terms extensively used in taxonomic work, partially because of the questionable homologies implied by the terminology in figure 12.

The *basitibial plate* is a plate on the outer side of the base of the hind tibia of many bees (fig. 15), presumably important for support as bees move up or down their burrows in the soil. Commonly it is surrounded by a carina or sharp line of some sort and has vestiture (if any) different from that of adjacent regions, but it may be indicated only by a series of tubercles, or even by a single tubercle, and in some cases (as in *Xylcopa*) is represented by a structure near the middle of the tibia.

Because the first abdominal segment is in-

corporated in the thorax and called the propodeum, the numbering of the subsequent abdominal segments varies among authors. Some, disregarding the homology of the propodeum with the first abdominal segment, number the segments of the apparent abdomen or metasoma from one onward. Others, mostly in partly or wholly morphological papers (e.g., Michener, 1944), number these same segments starting with two. In order to preserve the traditional numbering used by most taxonomists and at the same time maintain a moderate degree of morphological accuracy, I number the segments from one on but call them *metasomal segments* rather than abdominal segments.

Each metasomal tergum or sternum (except for the anteriormost and the reduced apical ones) consists of a plate commonly marked by some transverse lines, as follows: (1) Across the anterior margin, always completely hidden in the intact metasoma, is the antecosta. (2) Basal to the middle of each plate is another transverse line, the *gradulus*. The ends of the tergal graduli, unless bent strongly to the rear, are usually near the spiracles. The area anterior to the gradulus is usually at a slightly higher level than that posterior to it, so that the gradulus is like a minute step. The graduli are often concealed on the intact metasoma but, especially on the second tergum and sternum, are sometimes

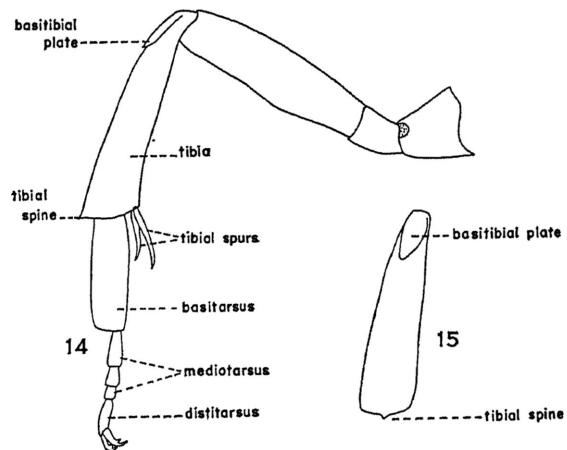


FIG. 14. Diagram of hind leg of a bee.

FIG. 15. Diagram of outer surface of hind tibia of a bee.

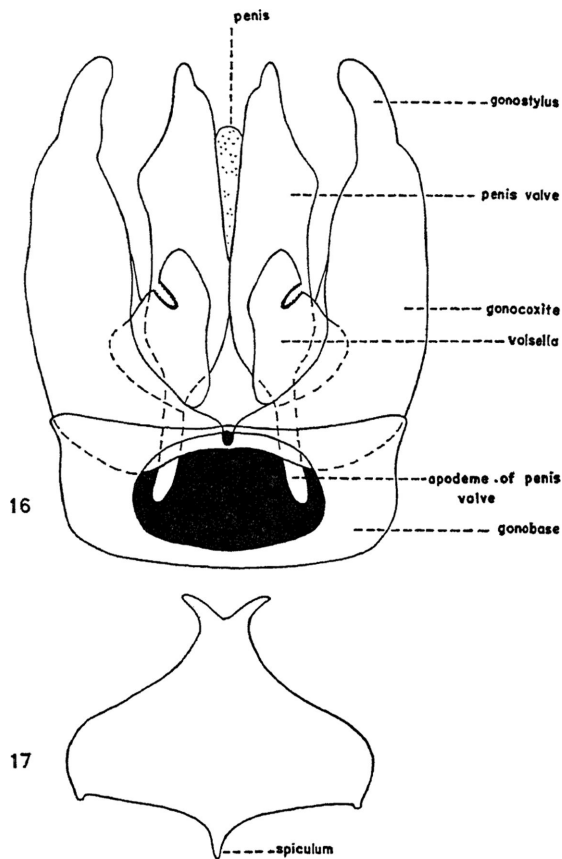


FIG. 16. Diagram of the male genitalia of a colletid.

FIG. 17. Diagram of the eighth metasomal sternum of a male bee.

exposed. (3) Near the posterior margin of each tergum and sternum is usually another transverse line separating the *posterior marginal area* from the rest of the sclerite. This area is in some instances depressed but in others differs only in sculpturing from the area basal to it.

The *pygidial plate* is a usually flat plate, commonly surrounded by a carina or line and in some cases produced as an apical projection, on the sixth metasomal tergum of females or the seventh of males. The *pre-pygidial fimbria* is a dense band of hairs

across the apex of the fifth metasomal tergum of females.

The genitalia and seventh and eighth metasomal sterna of male bees (figs. 16 and 17) exhibit many interesting characters and must be dissected out for study. In some groups, the sixth, fifth, and even the fourth sterna are also hidden and modified. On a fresh or relaxed specimen it is usually possible to reach between the apical exposed tergum and sternum and, with a hooked needle, pull out the genitalia and hidden sterna. In most bees such dissection is not difficult, but in the Megachilidae the numerous hidden sterna are firmly connected to one another and to the terga laterally and are often delicate medially so that successful dissection is often difficult. Beginners should start with other groups. For gross observations sterna and genitalia may be preserved dry, glued to a card on the pin with the specimen. For more detailed study they should be treated with 10 per cent potassium hydroxide or some other agent to remove the muscle tissue, acidulated in acetic acid, placed for study in glycerin, and transferred for preservation to microvials kept with the specimen by running the pin through the cork. No excess glycerin should be put in the vial; the amount that is carried on the structure itself in transferring it to the vial is sufficient. Larger amounts may creep past the cork and along the pin and damage the labels, specimen, and container. Preservation on slides has the disadvantage of making side views impossible, as well as crushing the genitalia which are often quite thick.

The median basal projection of the eighth sternum, which has no counterpart on other sterna, is called the *spiculum*. The names of parts of the genitalia are indicated in figure 16.

The *scopa* consists of the pollen-carrying hairs of female bees. In the Megachilidae they are on the venter of the metasoma. In other bees they are on the posterior legs, but are supplemented by hairs on the venter of the metasoma and sides of the propodeum in some Colletidae and Halictidae.

SYSTEMATIC TREATMENT

KEY TO THE FAMILIES OF THE APOIDEA OF THE AUSTRALIAN REGION¹

1. Labial palpus with first two segments elongate, flattened, and sheathlike (fig. 7); galea with postpalpal part greatly elongated, usually longer than stipes; glossa elongate and pointed, usually longer than prementum; middle coxa more than two-thirds as long as distance from summit to posterior wing base; pre-episternal groove absent below scrobal groove 2
- Labial palpi with segments similar and subcylindrical, not flattened and sheathlike (fig. 5); galea with postpalpal part much shorter than stipes; glossa shorter than prementum; middle coxa (or at least exposed part) much shorter than distance from summit to posterior wing base; pre-episternal suture or groove usually present below scrobal groove 4
2. Labrum longer than broad; subantennal suture directed toward outer margin of antennal socket; two submarginal cells; scopa, when present, on metasomal sterna. Megachilidae
- Labrum broader than long; subantennal suture directed toward inner margin of antennal socket; three submarginal cells (or in *Trigona* of the Apidae, veins weak and no distinct submarginal cells); scopa, when present, on posterior tibiae 3
3. Hind tibial spurs absent (except in *Bombus*, found in New Zealand); scopa of female forming corbicula on hind tibia (except in most queens); inner apical margin of hind tibia (except in some queens) provided with comb of stiff setae; pygidial plate completely absent; distance between costal ends of two recurrent veins (if present) nearly twice as great as length of second recurrent vein and longer than first recurrent Apidae
- Hind tibial spurs present; scopa of female not forming corbicula; inner apical margin of hind tibia without comb of stiff setae; pygidial plate present or absent; distance between costal ends of two recurrent veins (second may be absent) less than twice as great as length of second recurrent vein and shorter than or equal to first recurrent Anthophoridae
4. Inner hind tibial spur greatly broadened basally so that whole spur is crescentic, concave side finely ciliate (fig. 640); pre-episternal groove absent below scrobal groove; submentum V-shaped (northern Queensland and northward) Melittidae
- Inner hind tibial spur not broadened basally and crescentic; pre-episternal groove present below scrobal groove (except in Stenotritinae and *Hesperocolletes*); submentum absent or in form of plate but not V-shaped 5
5. Glossa broad, emarginate, truncate, or rounded apically in all females and most males, pointed in a few males; submentum present, in some cases only weakly sclerotized; mentum usually recognizable although often weakly sclerotized; galea usually not evenly tapering to pointed base, prepupal portion usually shorter than postpalpal portion Colletidae
- Glossa pointed apically; submentum and mentum absent or scarcely recognizable and not or feebly sclerotized; galea elongate prepupally and evenly tapering to pointed base, prepupal portion usually as long as postpalpal portion Halictidae

¹ Australian Region is used here and elsewhere to indicate the entire area covered by this study.

ARTIFICIAL KEY TO THE GROUPS OF BEES OF THE AUSTRALIAN REGION

Because the key to the families uses characters that are often difficult to see, I have made an artificial key, based on more obvious characters, that leads either to groups or to specific places in the keys to genera provided for the various subfamilies and tribes.

1. With one or two submarginal cells 2
- With three submarginal cells 13
2. Marginal cell open at apex (distal wing venation much reduced); hind tibia of worker with corbicula (smooth area surrounded by long hairs) on outer side *Trigona*
- Marginal cell closed at apex; corbicula absent 3
3. Stigma almost absent and basal to middle of wing (very large bees) *Xylocopa*
- Stigma distinct, distal to middle of wing 4
4. Inner hind tibial spur greatly broadened basally so that whole spur is crescentic (fig. 640) *Ctenoplectra*
- Inner hind tibial spur not broadened basally 5

5. Arolia absent or essentially so6
Arolia present and conspicuous between claws7
6. Jugal lobe of posterior wing about three-fourths as long as vannal; outer surfaces of tibiae of female with numerous large, bare spicules, those on each front and mid tibia in longitudinal row *Lithurge*
Jugal lobe of posterior wing less than half as long as vannal; outer surfaces of tibiae without large bare spicules, or spicules on anterior pair only Tribe Megachilini
7. Stigma very short, one-third as long as costal margin of marginal cell or less (tropical) Tribe Anthidiini
Stigma more than half as long as costal margin of marginal cell8
8. Mesepisternum without any evidence of pre-episternal groove below scrobal groove; scopa of female on tibia and basitarsus; proboscis long, apices of galeae in repose reaching posterior end of proboscoidal fossa
Go to couplet 2, Key to Genera of Ceratinini
Mesepisternum with distinct pre-episternal groove below scrobal groove; scopa of female on femur (and elsewhere) or absent; proboscis shorter, apices of galeae in repose not reaching posterior end of proboscoidal fossa9
9. Anterior tibial spine prolonged into long curved process at least as long as basitarsal diameter. (Black with yellow or red integumental markings like those of certain eumenid wasps.) *Hyleoides*
Anterior tibial spine small and inconspicuous10
10. Second submarginal cell about as long as first; jugal lobe of hind wing not greatly (if at all) exceeding cu-v; relatively hairy bees, females with scopa; pygidial plate broadened basally.11
Second submarginal cell much shorter than first, in some cases absent (open), in a few uncommon species nearly as long as first; jugal lobe of hind wing much exceeding cu-v; sparsely hairy, without scopa; pygidial plate of female absent or nearly parallel sided12
11. Metasoma with yellow integumental bands *Neopasiphae*
Metasoma without colored integumental bands
Leioproctus (couplet 2, Key to Subgenera)
12. Basitibial plate usually recognizable, in some cases very large and defined by a row of tubercles, in others defined only by a single tubercle representing apex of plate, in others defined in part or largely by carinae; pygidial plate of female present, a slender more or less parallel-sided band or process; anterior face of first metasomal tergum with longitudinal median groove
Subfamily Euryglossinae
Basitibial plate absent; pygidial plate absent or occasionally evident and triangular, broadest basally; anterior face of first metasomal tergum usually without longitudinal median groove
Go to couplet 2, Key to Genera of Hylaeinae
13. Posterior tibial spurs absent; hind tibia of worker with corbicula (bare area surrounded by long hairs) on outer side *Apis*
Posterior tibial spurs present; hind tibia without corbicula14
14. Marginal cell much shorter than first median; vein cu-v of hind wing strongly oblique and much more than half as long as second abscissa of M+Cu (except in *Nomada*)
Family Anthoporidae
Marginal cell little if any shorter than first median; vein cu-v of hind wing transverse and usually less than half as long as second abscissa of M+Cu (see *Stenotritinae*, in which cu-v is elongate and oblique in a different way)15
15. Stigma almost absent (large, robust bees)
Tribe Xylocopini
Stigma distinct, longer than broad16
16. Second submarginal cell on posterior side longer than first, measured on same side (large, robust bees; New Zealand)
Bombus
Second submarginal cell on posterior side shorter than first17
17. Mesepisternum without pre-episternal groove or this groove only weakly suggested above scrobal groove; scopa of female on tibia and basitarsus; proboscis long, apices of galeae in repose reaching beyond posterior end of proboscoidal fossa *Ceratina*
Mesepisternum with distinct pre-episternal groove usually continuing below scrobal groove; scopa of females on femur and elsewhere (scopa rarely absent); proboscis shorter, apices of galeae in repose not reaching posterior end of proboscoidal fossa18
18. First flagellar segment longer than scape.
Subfamily Stenotritinae
First flagellar segment shorter than scape19
19. Third submarginal cell at least three-fourths as long as first and more than twice as long as second; pre-episternal groove extending

- but little below scrobal groove . . . *Nomia*
 Third submarginal cell usually less than three-fourths of length of first and in every case less than twice as long as second; pre-episternal groove extending well below scrobal groove (except in *Hesperocolletes*) 20
20. Body with yellow integumental markings (including metasomal fasciae) (minute species with pale wings) *Nomioides*
 Without yellow integumental markings except in some cases on face (usually clypeus only) of males 21
21. Basal vein of forewing strongly curved (fig. 620); second recurrent and third transverse cubital veins usually distinctly weaker than first recurrent and first transverse cubital; prepygidial fimbria of female divided medially by longitudinal median furrow or line with distinctive hair pattern (furrow represented by triangular area in *Echthralictus*; prepygidial fimbria absent in *Sphécodes*)
 Go to couplet 2, Key to Genera of Halictinae
 Basal vein of forewing straight or gently curved; second recurrent and third transverse cubital veins as strong as other nearby veins; prepygidial fimbria of female undivided
 Tribe Paracolletini (except *Neopasiphae*)

FAMILY COLLETIDAE

This family is better represented in Australia than in any other continent. It is distinguished from other families by the short, blunt, truncate, or bifid glossa, apically pointed as in other bees only in males of a few genera of Hylaeinae. The form of the glossa is a wasplike characteristic and, together with other features, is responsible for the belief that the Colletidae are the most primitive family of bees, a belief substantiated by the predominantly southern distribution (see Michener, 1944).

The Colletidae are unique among bees in that they line or construct their cells, whether they are irregular and in pre-existing burrows or beautifully regular in shape as in those that construct isolated cells in the soil, with a translucent or transparent cellophane-like material applied by the broad glossa of the female. Some of the best accounts of the application of this material to cell walls were made in Australia by Rayment (1935, pp. 31, 55).

KEY TO THE SUBFAMILIES OF THE COLLETIDAE IN THE AUSTRALIAN REGION

1. With three submarginal cells or, if with two, second about as long as first; jugal lobe of hind wing not greatly (if at all) exceeding vein cu-v (except in *Callomelitta*); females with scopa and (in ours) with pygidial plate broadened basally; relatively hairy forms 2
 With one or usually two submarginal cells, second much shorter than first (except in *Hyleoides* and a few uncommon species of *Palaeorhiza*, and others); jugal lobe of hind wing much exceeding cu-v; females without scopa; pygidial plate, when present, usually narrow and more or less parallel sided; relatively bare or short-haired forms 3
2. Pre-episternal groove absent below scrobal groove; glossa short, blunt, apex rounded; first flagellar segment longer than scape Stenotritinae
 Pre-episternal groove extending well below scrobal groove (except in *Hesperocolletes* in which it is represented below scrobal groove only by broad, weak depression); glossa truncate or bilobed; first flagellar segment shorter than scape Colletinae
3. Pygidial plate of female present, a slender more or less parallel-sided band; basitibial plate usually recognizable, although often demarked only by a few tubercles or only the apex indicated by a tubercle; anterior face of first metasomal tergum with longitudinal median groove Euryglossinae
 Pygidial plate absent, or in the few species that possess it, broad basally rather than parallel sided; basitibial plate absent; anterior face of first metasomal tergum usually without longitudinal median groove Hylaeinae

SUBFAMILY COLLETINAE

This worldwide subfamily consists of moderate-sized, moderately to strongly hairy bees which transport pollen externally on the scopa rather than internally in the crop as do Hylaeinae and Euryglossinae. It differs from the only other group of hairy Colletidae in our area, the Stenotritinae, by the short first flagellar segment, the truncate or emarginate glossa, the presence of a pre-episternal groove extending well below the pleural scrobe (except in the genus *Hesperocolletes* in which only a shallow depression represents this groove), and by the presence of only one subantennal suture below each antenna.

TRIBE PARACOLLETINI

This is the only tribe of the subfamily Colletinae found in our area. The other tribe, the Colletini, is abundant in all continents except Australia, with many species in both temperate and tropical regions, but scarcely penetrates into the Oriental faunal region and does not reach our area at all. By contrast, the Paracolletini are panaustral, being exceedingly abundant in Australia, with only two species known from New Guinea, one (undescribed) from Misool, and none from farther northwest. The tribe occurs also in New Zealand, is well represented in temperate South America (with a lesser representation in the more arid parts of northeastern Brazil and with a very few species as far north as Mexico and Arizona), and is represented in South Africa.

The tribe differs from the Colletini by having a pygidial plate and a prepygidial fimbria and usually basitibial plates in the females.

KEY TO THE GENERA OF THE PARACOLLETINI
OF THE AUSTRALIAN REGION

1. *Marginal cell with apex on wing margin*; facial fovea linear or nearly so (often very short in male, or absent); mandible of female two to three times as long as basal width, ending in three equally conspicuous teeth; jugal lobe of hind wing five-sixths as long as vannal lobe or longer; basal elevation of labrum bituberculate; subantennal suture nearly twice as long as diameter of antennal socket; pygidial plate of female with lateral margins concave, apex very slender and parallel sided; gradulus of second sternum strongly bent at each side. (Inner hind tibial spurs finely ciliate; face and often other parts of body coarsely punctate; basitibial plates of female one-third, or nearly so, of male one-fifth to one-sixth, of length of tibia; three submarginal cells.) *Callomelitta*
- Marginal cell bent away from wing margin at apex*; facial fovea broad or absent; mandible of female four or more times as long as basal width, bidentate (inner tooth bilobed, giving a tridentate appearance, in *Paracolletes*); jugal lobe of hind wings one-fourth to three-fourths as long as vannal lobe; basal elevation of labrum, if recognizable, not bituberculate; subantennal suture usually not longer than diameter of antennal socket; pygidial plate of female with lateral margins not

- strongly concave (except in *Excolletes* and *Leioproctus fallax*), apex not slender and parallel sided; gradulus of second sternum transverse or, if bent back at each side, not continued far to rear 2
2. Claws (of male) with inner ramus arising near base and in form of broad, flat projection; pre-episternal groove below scrobal groove indicated only by weak, short depression; strong carina just behind posterior orbits *Hesperocolletes*
 - Claws (of male) cleft; pre-episternal groove distinct below scrobal groove; no strong carina behind posterior orbits 3
 3. *Stigma small, parallel sided, truncated (in some cases obliquely) at base of vein r or rarely shortly beyond that point, not or scarcely tapering to apex in marginal cell; margin of marginal cell on costal edge of wing 2.75 to five times as long as stigma*; basitibial plate of female absent or weakly defined or hidden by hairs which grade into those of outer side of tibia, or (in some *Trichocolletes*) clearly and completely defined but usually rounded apically and usually less than one-fifth as long as tibia; bare part of labrum uniformly convex, one to five times as broad as long; pre-episternal groove rather weak (broad and deep in *Paracolletes crassipes* and allies), lower end on outer surface of mesepisternum. (Large forms; facial foveae absent; propodeum mostly or entirely declivous, in some *Trichocolletes* with short, sloping, but undefined basal zone; three submarginal cells.) 4
 - Stigma usually larger and usually not parallel sided, apex usually tapering to a point on costal edge of marginal cell; margin of marginal cell on costal edge of wing 1.3 to 2.5 times as long as stigma*; basitibial plate of female clearly defined (defined only posteriorly in *Leioproctus dentiger*, absent from *Excolletes*) although occasionally hidden by hair, usually one-fifth as long as tibia or longer, apex angulate; bare part of labrum usually with transverse ridge or otherwise not uniformly convex, usually more than five times as broad as long; pre-episternal groove strong, lower end curved anteriorly, usually ending at or on anterior surface of mesepisternum. (Basitibial plate of male defined, pointed apically, anterior margin rarely weak or absent.) 5
 4. *Basitibial plates of females and some males fully defined*, in some cases visible without removal of hairs; apex of plate rounded or blunt (angulate in *montanus*); *inner hind tibial spur of female finely serrate, rarely finely*

pectinate, with slender teeth of approximately uniform length arising from a shaft which tapers rather uniformly toward apex; mandible slender near base, usually expanded apically, females with inner apical tooth bidentate in unworn mandibles, so that *mandibular apex of female is tridentate*; eyes parallel or converging below. (Claws of female cleft.) *Paracolletes*

Basitibial plate of female defined only along posterior margin, or at least apex not defined, plate never visible without removal of hairs, plates of males variable, if defined, acutely pointed; inner hind tibial spur of female coarsely pectinate, shaft thick near base and narrowing rather abruptly in region where most of teeth arise; mandibles approximately parallel sided, apices bidentate; eyes often diverging below . . . *Trichocolletes*

5. Female with interantennal distance less than half of oculo-antennal distance; male with clypeo-antennal distance one-half to one-fourth of diameter of antennal socket, in female this distance about three-fourths of diameter of antennal socket; scape in female strongly curved, in male greatly broadened; *metasoma with transverse, pale yellow, integumental bands*, emarginate anteriorly or broken sublaterally, on subapical parts of terga; inner hind tibial spur pectinate, with nine to 12 short fine teeth which are longest beyond middle of spur. (Two submarginal cells; clypeus yellow in both sexes; legs of male modified, hind basitarsi much broadened.) *Neopasiphae*

Interantennal distance usually not much less than oculo-antennal distance; clypeo-antennal distance little if any less than diameter of antennal socket (except in *Excolletes*); scape usually less strongly curved, not broadened; *metasoma without yellow integumental bands*, yellowish brown bands occasionally present

but not emarginate or broken sublaterally; inner hind tibial spur ciliate or serrate with many fine teeth to pectinate with few coarse teeth of which the basal ones are usually longest (median ones longest in some species of *Euryglossidia* and others). (Clypeus dark in females, rarely yellow in male.) *Leioproctus*

PARACOLLETINI (PROBABLY *Leioproctus*) NOT PLACED IN THE PRESENT CLASSIFICATION

chalcus Friese, 1924 (*Dasycolletes*) (desc.)
crassipes Friese, 1924 (*Dasycolletes*) (desc.) (not *Paracolletes crassipes* Smith, 1853)
frontalis Smith, 1853 (*Leioproctus*) (desc.). The "type" in B.M. is false and is in fact the type of *waterhousei* Cockerell

GENUS CALLOMELITTA SMITH

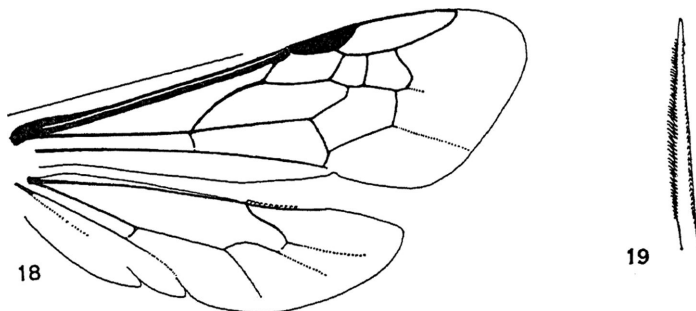
Plate 1, figures 1, 2; text figures 18–25

Callomelitta SMITH, 1853, p. 85. Type: *Callomelitta picta* Smith (monobasic).

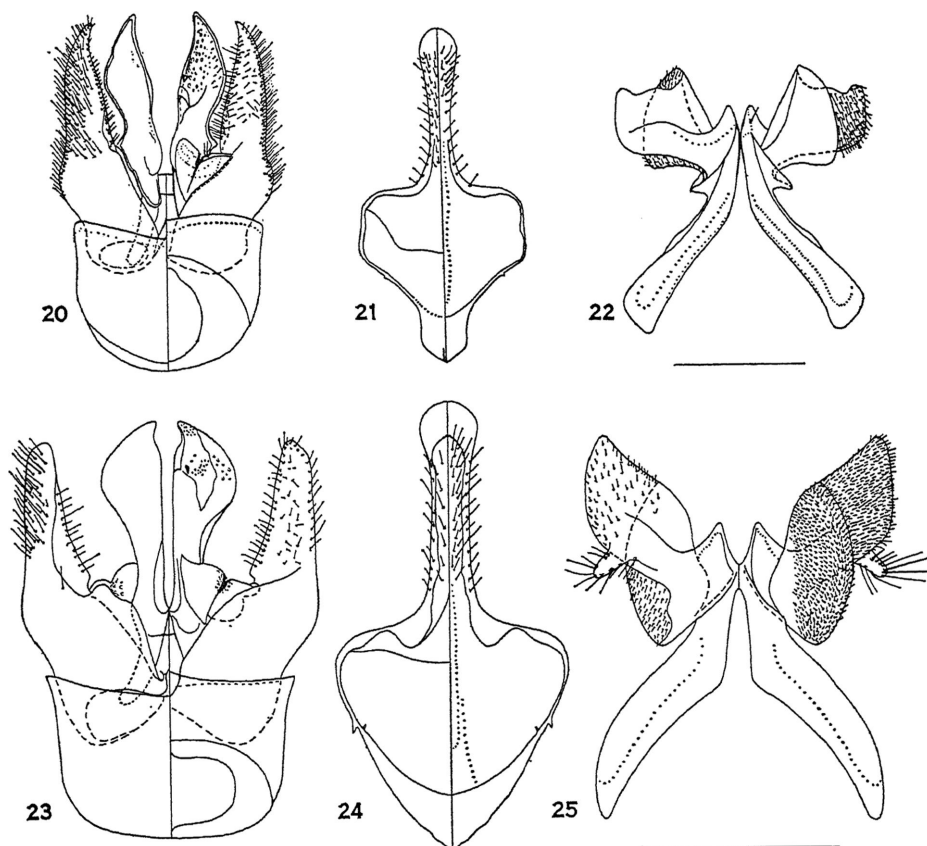
Binghamiella COCKERELL, 1907a, p. 235. Type: *Sphecodes antipodes* Smith (monobasic). New synonymy.

Pachyodonta RAYMENT, 1954a, p. 48. Type: *Binghamiella (Pachyodonta) fulvicornis* Rayment (monobasic). New synonymy.

This genus is here used in a new broad sense for not only the previously included forms but also for the species formerly placed in *Binghamiella*. The type species of *Binghamiella* differs from *Callomelitta* of previous authors in the nonmetallic, usually red metasoma (metallic blue-black in typical *Callomelitta*, but red and black in *C. fulvicornis* and red in *C. turnerorum*), the slightly broader pygidial plate of the female, the slightly denser and less spreading scopa, the smooth rather than nodulose margins of the basitibial



FIGS. 18, 19. Colletinae. 18. Wings of *Callomelitta picta* (scale line represents 5 mm.). 19. Inner hind tibial spur of female of *C. antipodes*.



FIGS. 20-25. Male genitalia and eighth and seventh sterna of Colletinae. 20-22. *Callomelitta littleri*. 23-25. *C. antipodes*. Scale lines represent 0.5 mm.

plate of the female, and the more slender mandibles (those of female three times as long as basal width instead of two times, *turnerorum* intermediate).

The shape of the propodeum, which often provides important group characters, is variable. The horizontal basal part of the triangular area is separated by a strong carina from the vertical posterior part, and much of the propodeum is areolate because of carinae, not only in *Binghamiella* but also in *C. littleri*, *rugosa*, and *fulvicornis*. In other species the propodeum is relatively smooth except for dorsolateral carinate projections, and in *turnerorum* the basal part of the triangular area is declivous at about 45 degrees.

In view of the characters indicated in the above discussion, it seems clear that no satisfactory division between *Callomelitta* and *Binghamiella* can be maintained.

Pachyodonta was based on a species, *fulvicornis*, supposed to have very short and bidentate mandibles in the female. In reality, the mandibles are tridentate and, although badly worn in the type, are shaped much as in *C. picta*. Persons who may wish to retain *Binghamiella* as a genus or subgenus should place *Pachyodonta* as a synonym of *Callomelitta*, not of *Binghamiella*.

Nests of *Callomelitta* are made in rotting wood (Rayment, 1935, 1959b).

DISTRIBUTION: Tasmania, Australia north to northern Queensland. [Only *C. antipodes* is known in Western Australia (Yallingup).]

INCLUDED SPECIES

Callomelitta antipodes (Smith, 1853) (*Sphecodes*)
n. comb. (B.M.) = *antipus* Sichel, 1865 (unnecessary emendation)
chlorura Cockerell, 1929b (A.M.N.H.)

cyanescens Friese, 1924 (desc.)
fulvicornis (Rayment, 1954a) (*Binghamiella*) n. comb.
insularis (Cockerell, 1914j) (*Binghamiella*) n. comb. (B.M.)
littleri Cockerell, 1914m (B.M.)
nigra (Rayment, 1929c) (*Binghamiella*) n. comb. (cotype C.S.I.R.O.)
nigrofasciata Cockerell, 1918a (A.M.N.H.)
nigriventris Friese, 1924 (desc.)
perpicta Cockerell, 1910i (Berlin*)
picta Smith, 1853 (B.M.)
rugosa (Cockerell, 1915b) (B.M.)
turnerorum Cockerell, 1910e (B.M.)
wilsoni Cockerell, 1929a (A.M.N.H.)

Callomelitta anomala Rayment (1935) is a species of *Lasioglossum* (*Callalictus*), as an examination of the type shows.

GENUS LEIOPROCTUS SMITH

Plate 1, figures 3–12; plate 2; plate 3, figures 1–11; text figures 26–166

This genus as here defined becomes a major group of bees, equivalent in variation among its species to groups such as *Andrena*, *Lasioglossum*, *Chalicodoma*, *Megachile*, and the like. It contains many Australian species (great numbers of them still undescribed), two species from New Guinea, one from Misool, one from New Caledonia, a few from New Zealand, a considerable group from temperate South America, and a few from semidesert and savanna areas of eastern Brazil. It probably also includes some species, currently placed in *Polyglossa*, from South Africa, although I have not studied these African forms in detail.

In Australia the name *Leioproctus* should be applied to a large number of the species placed in *Paracolletes* by Cockerell and Rayment (a procedure that was, in fact, suggested by Cockerell, 1929d), and in addition the species hitherto placed under the generic names *Andrenopsis*, *Euryglossidia*, *Nodocolletes*, *Notocolletes*, *Goniocolletes*, *Phenacolletes*, and *Cladocerapis*. The groups called *Andrenopsis* and *Euryglossidia* have received generic status in the past only because of having two instead of three submarginal cells. In a few bees (including *L. abnormis*) this character is not even specific, and it is certainly no more important than any one other feature. In *Leioproctus* most of the forms with two cells seem reasonably distantly related to those with three cells; hence the character is usually

of subgeneric importance. However, *Euryglossidia*, with two cells, appears almost to merge with *Leioproctus* proper, having three. Several of the other subgenera of *Leioproctus* merge or nearly merge. For these reasons the groups do not, in my opinion, warrant generic rank, in spite of the great diversity of the extremes. The details of these relationships are explained in some cases under the various groups below. The general picture with regard to our area is as follows:

The subgenus *Leioproctus*, *sensu stricto*, more particularly its *metallicus* group, is possibly the most primitive. This group contains quite ordinary-appearing species and is found, so far as known, only in New Zealand and southwestern Australia. Its most distinctive and probably primitive character is the ciliate rather than pectinate inner hind tibial spur of the female. A segregate of this group found only in New Zealand is called *Nesocolletes*, while the Australian *Colletellus* and *Urocolletes* may have arisen from *Leioproctus*, *sensu stricto*, to judge by the ciliate spurs. Through such species as *maritimus*, which has the projections on the spur long but still numerous, the *metallicus* group merges with the bulk of *Leioproctus*, *sensu stricto*, in which inner hind tibial spurs of the females are pectinate. Some species such as *sexmaculatus* and especially *abnormis* have slender teeth on the spur although distinctly fewer of them than in the *metallicus* group. *Leioproctus* is an enormous and diversified subgenus from which many divergent lines have evolved. Several of these, not sufficiently well differentiated because of annectant forms, have not received subgeneric status. The remaining subgenera of our area probably arose from *Leioproctus* proper, except that *Notocolletes* is most likely a derivative of *Euryglossidia*.

The most noteworthy feature of the study of the genus is that, while membership in the genus is indicated by a complex of characters, no one of these is invariable, and indeed characters that elsewhere among bees are usually regarded as of at least generic importance vary within this genus. Thus arolia are absent from *Urocolletes*; claws are simple instead of cleft in females of several groups, with all intermediate conditions existing in the *platycephalus* group of *Leioproctus*, *sensu stricto*, and in *Euryglossidia*; basitibial plates are

partly gone in one species of *Nodocolletes*, wholly gone in females of *Exocolletes*; and the apical lobes of the seventh metasomal sternum of the male, often considered as characteristically present in this family and related ones, vary from four in number (*Andrenopsis*, *Ceratocolletes*, *Euryglossidia*, and the *advenus* group of *Leioproctus*, *sensu stricto*) to two in most forms, these being very much reduced in *Nesocolletes* and *Anacolletes* and altogether absent from *Phenacolletes*.

In South America the genus *Leioproctus* as I understand it contains many groups and is nearly as diversified, although not so large, as in Australia. Perhaps because the number of species is fewer in South America, or because less favorable conditions have eliminated many annectant forms, the South American species have with much justification been segregated into a number of genera, and *Leioproctus* has never been regarded as occurring there. The South American groups, however, are no more different from one another than are the various subgenera in Australia, which merge one into another. A feature that has been regarded as a prime generic character in South America, namely, the inner hind tibial spur of the female (pectinate versus ciliate) is not always even a subgeneric character in Australia. In both *Leioproctus*, *sensu stricto*, and *Euryglossidia* it varies from pectinate to ciliate. Claws of the female vary from simple to cleft in a single species group of *Leioproctus*, *sensu stricto*, in Australia. The male genitalia and hidden sterna provide excellent specific as well as group characters in both continents, but care must be taken not to regard striking genitalic or sternal differences as necessarily indicative of generic segregation in this group. *Leioproctus* (*Chrysocolletes*) *moretonianus* and *crenulatus* are so different in these features that one might easily consider them generically different. Yet in many other features they show definite indications of relationship, so that I ultimately, with hesitation, placed them in the same subgenus. In a related group at a different level, *Stenotritus* and *Ctenocolletes* are so similar externally that they have never before been properly separated. The male genitalia and sterna, however, almost seem to differ at the subfamily or family level. It would appear that in this group of bees

external features are relatively conservative (I believe not convergent) and the hidden male structures subject to relatively rapid evolution and therefore not necessarily useful for the delimiting of major groups.

Joining under a single generic name so many species which have previously been placed in different genera, in different continents, raises a number of nomenclatural problems. I do not believe that the existence of such nomenclatural problems should inhibit biologists from making changes in classifications, even tentative changes. Therefore I have suggested alternative nomenclatural practices which would obviate changes in names as a result of classificatory changes and thus free classification from the straitjacket of nomenclature (Michener, 1963e) and have used this group of bees as an example of the application of such practices (Michener, 1964c). However, since we currently use the binomial system and are bound by the usual rules of nomenclature, nomenclatural changes have been made in accordance with those rules, except for some South American species with which I am not acquainted and for which the new names should be provided by the describer.

To explain the proposed arrangement it has seemed best to list the South American species of *Leioproctus*. The nomenclatural problems start at the suprageneric level, for Moure (1945), probably unaware of the almost simultaneous placement of South American forms in the Paracolletini (Michener, 1944), proposed the subfamily name Lonchopriinae. This is a synonym of Paracolletini. *Eulonchopria* Brèthes, *Hexaniheda* Ogloblin, and *Tetraglossula* Ogloblin appear to be distinct at the generic level, although all are similar to *Leioproctus*, especially the last two, with *Tetraglossula* only questionably distinct. All the other South American Paracolletini fall in the genus *Leioproctus*.

The following is a list¹ of names applied to

¹ I am indebted to Padre J. S. Moure of the Universidade do Paraná for the use of a manuscript catalogue (1957) with the aid of which much of this list was organized. Padre Moure believes that many genera should be recognized instead of the single genus of the present classification. We agree, however, on the relationships, and both of us believe that the levels of the categories are of no great importance so long as their relative positions are recognized.

South American species of the genus. All are *new combinations* in *Leioproctus*. Subgeneric names preceded by an asterisk (*) represent groups that I have not studied but that are tentatively placed in *Leioproctus*.

Subgenus *Spinolapis* Moure, 1951 (= *Pasiphae* Spinola, 1851, not Latreille, 1819)

Leioproctus caeruleus (Spinola, 1851)
cyaneus (Cockerell, 1915)
melanurus (Cockerell, 1917)

Subgenus *Edwyniana* Moure, 1954 (= *Edwynia* Moure, 1951)

Leioproctus flavicornis (Spinola, 1851)
tristis (Spinola, 1851)

Subgenus *Bicolletes* Friese, 1908

Leioproctus abdominis, new name for *Pasiphae abdominalis* Ducke, 1912, Zool. Jahrb., Abt. Syst., vol. 34, p. 77, not *Paracolletes abdominalis* Smith, 1879, a species of the subgenus *Goniocolletes*

alismatis (Ducke, 1908)

andinus (Herbst, 1923)

armatus (Joergensen, 1912) [homonym of *L. (Biglossidia) armatus* (Friese, 1906) but a synonym of *wagneri*, hence does not need a new name]

arnauui (Moure, 1954) [homonym of *L. (Nomio-colletes) arnauui* Moure, 1959]

basirufus (Schroettky, 1920)

bicellularis (Ducke, 1910)

cestri (Ducke, 1912)

chrysostomus (Cockerell, 1917)

coloratipes (Cockerell, 1933)

decoloratus (Ducke, 1908)

fasciatus (Schroettky, 1920)

ferrugineus (Moure, 1954)

franki (Friese, 1908)

friesei (Ducke, 1912)

iheringi (Schroettky, 1910)

leucostomus (Cockerell, 1917)

longipes (Ducke, 1912)

lucidulus (Cockerell, 1933)

moerens (Vachal, 1909)

neotropicus (Friese, 1908)

palpalis (Ducke, 1908)

peruvianus (Cockerell, 1926)

pharcidodes (Moure, 1954)

pseudozonatus (Moure, 1954)

rufiventris (Spinola, 1851)

saltensis (Friese, 1908)

seydi (Strand, 1910)

spegazzinii (Joergensen, 1912)

stictus (Moure, 1954)

stilborhinus (Moure, 1954)

wagneri (Vachal, 1909)

Subgenus *Perditomorpha* Ashmead, 1899
 (= *Holmbergia* Joergensen, 1912)

Leioproctus brunerii (Ashmead, 1899)
cristariae (Joergensen, 1912)

Subgenus *Belopria* Moure, 1956

Leioproctus nitidior (Moure, 1956)
zonatus (Moure, 1956)

Subgenus *Biglossidia* Moure, 1948

Leioproctus aeneus (Friese, 1906)
armatus (Friese, 1906)
chalybaeus (Friese, 1906)
deceptrix (Moure, 1949)

Subgenus *Brachyglossula* Hedicke, 1922
 (= *Brachyglossa* Friese, 1922)

Leioproctus boliviensis (Vachal, 1901)
bouvieri (Vachal, 1901)
rufocoeruleus (Friese, 1922)

Subgenus *Nomiocolletes* Brèthes, 1909

Leioproctus arnauui (Moure, 1949) (senior homonym of a species of *Bicolletes*)
cearensis (Ducke, 1908)
jenseni (Friese, 1906)
joergenseni (Friese, 1908)

Subgenus *Lonchopria* Vachal, 1905

Leioproctus alopex (Cockerell, 1917)
fazii (Herbst, 1923)
herbsti (Vachal, 1905)
ibanezii (Ruiz, 1945)
inca (Cockerell, 1914)
luteipes (Friese, 1916)
rubriventris (Friese, 1909)
rufithorax (Ruiz, 1945)
ruizi (Herbst, 1923)
similis (Friese, 1906)
zonalis (Reed, 1892) = *spinolae* (Dalla Torre, 1896) = *Colletes marginata* Spinola, 1851

Subgenus *Ctenosibyne* Moure, 1956

Leioproctus cingulatus (Moure, 1956)

Subgenus *Aeganopria* Moure, 1949

Leioproctus nivosus (Vachal, 1909)

Subgenus *Biglossa* Friese, 1906

Leioproctus thoracicus (Friese, 1906)

Hoplocolletes, new subgenus¹

Leioproctus ventralis (Friese, 1924)

¹ This subgenus is described here, since it is based on a species attributed to Australia. I had already described it as an Australian subgenus when I came across specimens from Floresta de Tijuca, Rio de Janeiro, Brazil, given me by Dr. C. A. Campos Seabra. (*Continued.*)

* Subgenus *Stenocolletes* Schrottky, 1909

Leioproctus pictus (Schrottky, 1909)

* Subgenus *Protodiscelis* Brèthes, 1909

Leioproctus fiebrigi (Brèthes, 1909)

* Subgenus *Orphana* Vachal, 1909 (= *Leptoglossa* Friese, 1929)

Leioproctus inquirendus (Vachal, 1909)
paradoxus (Friese, 1925)

* Subgenus *Halictanthrena* Ducke

Leioproctus malpighiacearum (Ducke, 1907)

SOUTH AMERICAN SPECIES NOT PLACED AS TO SUBGENUS

Leioproctus laticeps (Friese, 1906)
leana (Vachal, 1909)
orientalis (Vachal, 1904)

HOPLOCOLLETES, NEW SUBGENUS

TYPE SPECIES: *Dasycolletes ventralis* Friese, 1924.

This subgenus seems to be similar to *Leioproctus*, *sensu stricto*, with which it agrees in general form, in wing venation, and in other features. Among American species its body form is more like that of *Bicolletes*, being more slender than *Lonchopria*. It differs strikingly in the features italicized below from all other subgenera. Unfortunately only the female is known.

Body black, rather sparsely hairy; facial fovea absent; apex of scape reaching upper margin of median ocellus: *median ocellus, seen in profile, midway between posterior edge of vertex and antennal bases; upper part of head, seen from front, strongly convex* rather than more or less horizontal between summits of eyes; clypeus slightly convex in profile, not much protuberant; antennae arising about middle of face; epistomal suture distinct; three submarginal cells; stigma large, long, not quite parallel sided, two-thirds as long as costal side of marginal cell; jugal lobe of hind wing reaching cu-v; *head and thorax very coarsely punctate, scutum and scutellum cribrate*; metasoma with first two terga smooth and shining, others rather finely and closely punctate; propodeal triangle with slightly sloping basal part about as long as metanotum, curving onto subvertical part; *tibial scopa sparse, hairs coarse, very long, simple or with only one or a few branches*; inner hind tibial spur pectinate; *metasomal sterna 2 to 5 with dense, long, simple hairs with curved tips, forming what resembles in appearance the scopa of a megachilid*.

The only known species is *Leioproctus* (*Hoplocolletes*) *ventralis* (Friese, 1924). A specimen marked "Sydney, Australia, 14.9.06 (Frank), *typus*" in the American Museum of Natural History is identical with one from Alto de Boa Vista, Tijuca, Rio de Janeiro, Brazil, February (C. A. C. Seabra). As the species has not been taken again at Sydney and has been taken several times in the Tijuca area by Seabra, there is no doubt that it is Brazilian and that the Sydney label is an error. *Leioproctus ventralis* has been described in some detail by Cockerell (1929b).

paraguayensis (Schrottky, 1907)

parvus (Cockerell, 1917)

personatus (Cockerell, 1939)

porteri (Ruiz, 1936)

rufipennis (Cockerell, 1917)

semicyaneus (Spinola, 1851)

Some of the species described in *Bicornelia* are probably also *Leioproctus* although typical *Bicornelia* is a quite different genus.

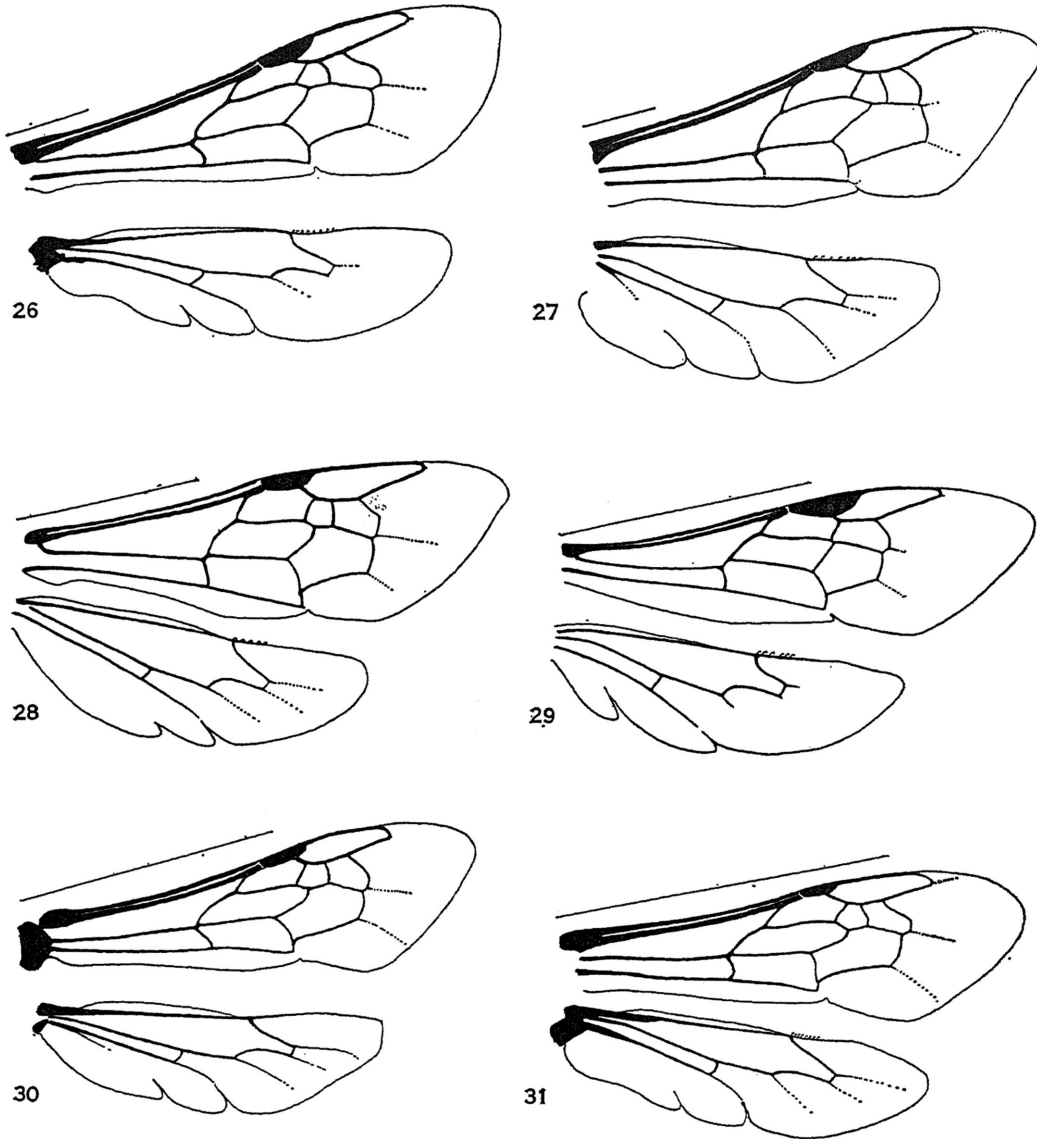
In addition to *Polyglossa*, which, as already indicated, is probably a subgenus of *Leioproctus*, there exists in South Africa another genus of the Paracolletini, namely, *Scrapter* (= *Strandiella*). These bees have a large stigma, two submarginal cells, ciliate hind tibial spurs in the female, distinct, impressed, and often narrow facial foveae, and a tendency toward simple claws. The characters that seem to make it reasonable to regard *Scrapter* as a genus distinct from *Leioproctus* are as follows: lateral fovea of second tergum distinctly impressed; basal vein of forewing far beyond m-cu, long and rather straight; jugal lobe of hind wing at least five-sixths as long as vannal, much exceeding cu-v; vein M+Cu of hind wing markedly longer than vein M.

It is hoped that the key below will be a useful outline and guide to the discussions and descriptions that follow. It is clear, however, that its use for identification purposes will result in much frustration. This situation can be corrected only when more material is collected and both sexes become known for all groups.

The species of *Leioproctus* nest in the soil, constructing one cell at the end of each lateral burrow radiating from the bottom of the main shaft. Nests of species in our area have been described by Rayment (1935) and Michener (1960c) under the generic name *Paracolletes*, by Rayment (1950a, 1954a) under the generic name *Cladocerapis*, and by Rayment (1952) under the generic name *Andrenopsis*.

KEY TO THE SUBGENERA OF *Leioproctus* OF THE AUSTRALIAN REGION

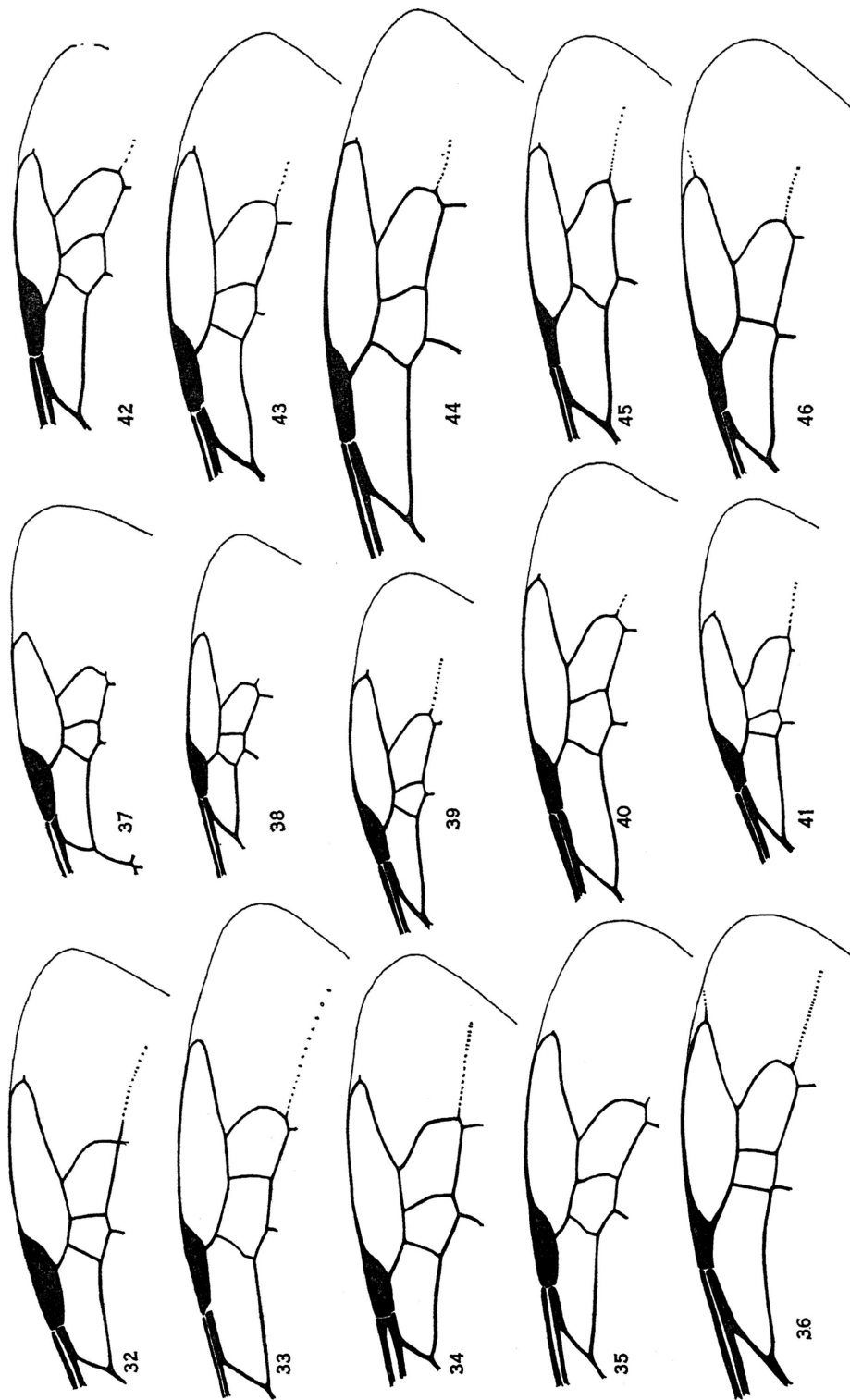
1. With two submarginal cells 2
With three submarginal cells [except some specimens of *L. (Leioproctus) abnormis*] . . . 7
2. First recurrent vein basal to first transverse cubital; clypeus and supraclypeal area usually flat, depressed, shining, largely impunctate; hind tibial spurs robust, curved apically, outer one nearly as coarsely



FIGS. 26-31. Wings of the Colletinae. 26. *Leioproctus (Leioproctus) insularis*. 27. *L. (L.) papuanus*. 28. *L. (Protomorpha) tarsalis*. 29. *L. (Filiglossa) filamentosus*. 30. *L. (Nodocolletes) dentiger*. 31. *L. (Chrysocolletes) moretonianus*. Scale lines for 26 to 29 represent 1 mm.; for 30 and 31, 5 mm.

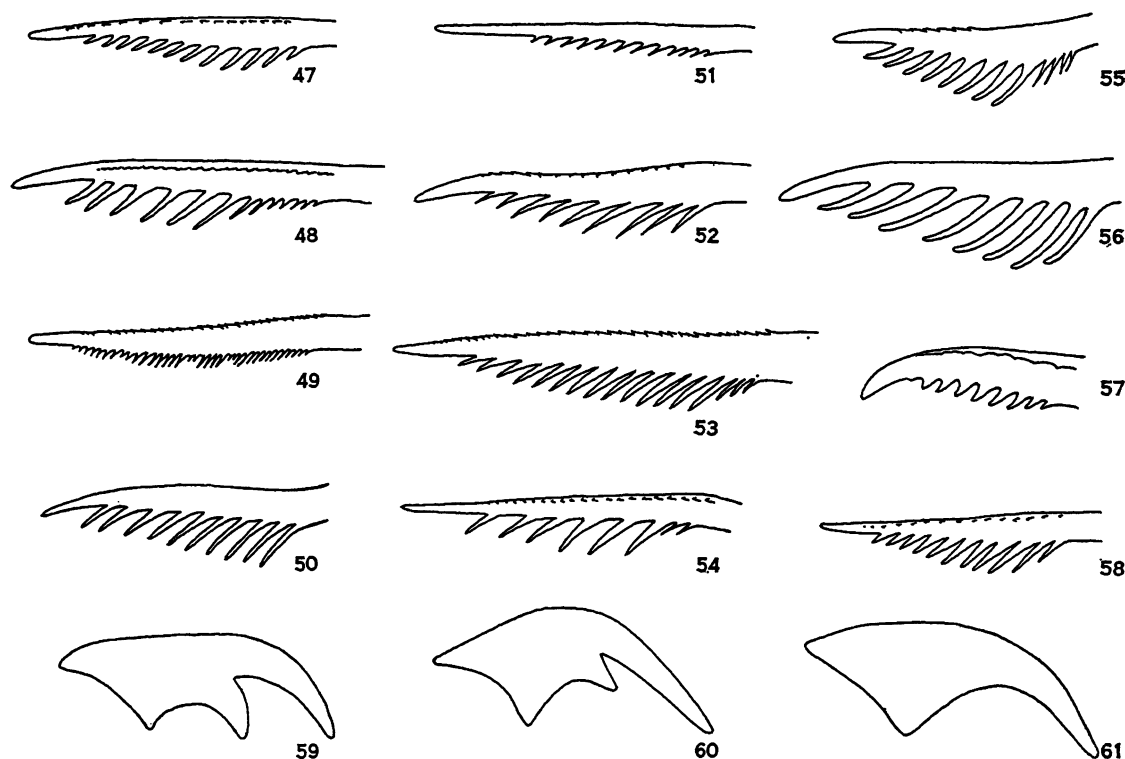
toothed as inner *Baeocolletes*
First recurrent vein distal to or rarely interstitial with first transverse cubital; clypeus and supraclypeal area convex, the latter elevated above level of antennal sockets; hind tibial spurs slender, not strongly curved apically, outer one not coarsely toothed 3
3. Propodeum with broad basal subhorizontal or

horizontal surface, curving onto vertical posterior surface; stigma large, not parallel sided, at least two-thirds as long as marginal cell on costal margin of wing . . . 4
Propodeum almost wholly vertical; stigma small, nearly parallel sided, little more than half as long as marginal cell on costal margin of wing *Andrenopsis*
4. Jugal lobe of hind wing extending well beyond



FIGS. 32-46. Portions of forewings of Colletinae. 32. *Leioproctus (Leioproctus) unguidentatus*. 33. *L. (L.) megachalcoides*. 34. *L. (L.) subpunctatus*. 35. *L. (Nesocolletes) fulvescens*. 36. *L. (Phenocolletes) minus*. 37. *L. (Excolletes) impatellatus*. 38. *L. (Microcolletes) halictomimus*. 39. *L. (Anacolletes) bimaculatus*. 40. *L. (Urocolletes) rhodurus*. 41. *L. (Glossurocolletes) xenoceratus*. 42. *L. (Colletopsis) contrarius*. 43. *L. (Ceratoletes) antennatus*. 44. *L. (Goniocolletes) dolosus*. 45. *L. (Andrenopsis) flavorufus*. 46. *L. (Baeocolletes) calcaratus*.

- level of cu-v; inner hind tibial spur of female ciliate *Colletellus*
- Jugal lobe of hind wing short, not attaining level of cu-v; inner hind tibial spur of female usually pectinate 5
5. First recurrent vein approximately interstitial with first transverse cubital; galea with very long hairs; labial palpi filamentose *Filiglossa*
- First recurrent vein far beyond first transverse cubital; mouthparts unmodified 6
6. Legs of male unmodified *Euryglossidia*
- Legs of male strongly modified (figs. 151-153) (female unknown). *Notocolletes*
7. Arolia absent (male unknown). *Urocolletes*
- Arolia present 8
8. Basitibial plate of female entirely absent, of male between one-sixth and one-seventh of length of tibia; pygidial plate with apical part nearly parallel sided in female. (Claws of female simple.) *Excolletes*
- Basitibial plate present (anterior side not defined in one species of *Nodocolletes*); pygidial plate of female broad, sides converging posteriorly [except in *L. (Microcolletes) fallax*] 9
9. Clypeus and supraclypeal area flat, depressed, shining, at least partly impunctate (longitudinally striate in *clypeatus*), suture separating them weak; anterior basitarsus of female with long coarse bristles on outer surface *Cladocerapis*
- Clypeus and supraclypeal area not flat, usually punctate, suture separating them distinct (weak or absent in *Protomorpha*); anterior basitarsus with ordinary vestiture 10
10. Dorsolateral angles of pronotum much elevated above adjacent scutal surface so that pronotal margin between them is concave (male unknown) *Colletopsis*
- Dorsolateral angles of pronotum weak or absent, dorsal margin of pronotum not concave 11
11. Malar area more than half as long as broad. (Seventh metasomal sternum of male with apical lobes reduced.) (New Zealand.) *Nesocolletes*
- Malar area very short. (Seventh metasomal sternum usually with two large apical lobes.) (New Zealand, Australia, and New Guinea and adjacent islands) 12
12. With one hind tibial spur (males) 13
- With two hind tibial spurs 14
13. Hind tibia and basitarsus broad (fig. 107); propodeal triangle largely areolate (female unknown) *Protomorpha*
- Hind tibia and basitarsus somewhat modified but slender; propodeal triangle not areolate. (Usually one of hind tibial spurs very minute rather than absent.) *Goniocolletes* (a few)
14. Scape of female not attaining anterior ocellus (female unknown in *Anacolletes*). (Small, robust, nonmetallic, commonly strongly punctate species; wings not reaching beyond apex of metasoma; flagellum short in both sexes, middle segments mostly broader than long or scarcely longer than broad; propodeum seen in profile with horizontal area, if present, usually shorter than metanotum.) 15
- Scape of female usually attaining anterior ocellus, if shorter (as is common in males) not agreeing with characters listed in parentheses above 17
15. Eighth metasomal sternum of male ending in two very large, long, ligulate processes; hind tibial spurs thick and strongly curved (probably in both sexes). *Glossurocolletes*
- Eighth metasomal sternum ending in a single median projection; hind tibial spurs neither thick nor strongly curved 16
16. Seventh metasomal sternum of male with apical lobes small, broadly attached to body of sternum; terga without apical hair bands *Anacolletes*
- Seventh metasomal sternum of male with two large apical lobes; terga often with apical hair bands *Microcolletes*
17. Metanotum with median tubercle (in some cases weak), projection, spine, or bifid process; propodeum seen in profile vertical or nearly so, without subhorizontal basal area. (Nearly always metallic species.) *Nodocolletes*
- Metanotum without median elevation or, if with small median tubercle, then propodeum with distinct basal horizontal area . 18
18. Anterior ocellus in male about midway between antennal bases and posterior margin of vertex, in female little behind midpoint; propodeum essentially vertical seen in profile. (Nonmetallic; stigma small, about half as long as costal edge of marginal cell.) 19
- Anterior ocellus usually much farther from antennal bases than from posterior margin of vertex; propodeum with subhorizontal basal area which rarely is so sloping as to be almost vertical 20
19. First recurrent vein received at base of second submarginal cell; hair of legs (in male) short and appressed so that insect has wasp-like aspect; seventh metasomal sternum of male bidentate at apex but without apical



FIGS. 47-58. Inner hind tibial spurs of females of Colletinae. 47. *Leioproctus* (*Andrenopsis*) *douglas-iellus*. 48. *L.* (*Leioproctus*) *megachalcoides*. 49. *L.* (*Nesocolletes*) *fulvescens*. 50. *L.* (*Microcolletes*) *halictomimus*. 51. *L.* (*Excolletes*) *impatellatus*. 52. *L.* (*Anacolletes*) *bimaculatus*. 53. *L.* (*Urocolletes*) *rhodurus*. 54. *L.* (*Colletopsis*) *contrarius*. 55. *L.* (*Ceratocolletes*) *antennatus*. 56. *L.* (*Goniocolletes*) *dolosus*. 57. *L.* (*Baeocolletes*) *calcaratus*. 58. *L.* (*Chrysocolletes*) *moretonianus*.

FIGS. 59-61. Claws of females of Colletinae. 59. *Leioproctus* (*Leioproctus*) *semipurpureus*. 60. *L.* (*L.*) *unguidentatus*. 61. *L.* (*L.*) *truncatulus*.

- lobes (female unknown) . . . *Phenacolletes*
 First recurrent vein received near middle of second submarginal cell; hair of legs of ordinary sort; seventh metasomal sternum of male with two apical lobes
 *Chrysocolletes*
 20. Metasoma, including apical marginal areas of terga, densely punctate in females; clypeus, at least in female, with longitudinal median shining convexity so that clypeus is protuberant; claws of female simple; last antennal segment of male enlarged and flattened *Ceratocolletes*
 Metasoma not densely punctate, or, if so, marginal areas of terga not similarly punctate; clypeus not usually protuberant; claws of female usually cleft; last antennal segment of male unmodified 21
 21. Facial foveae commonly impressed; stigma small, slender, parallel sided, little if any more than half as long as that part of mar-

ginal cell on wing margin; metasomal terga often with basal hair bands and often with very broad translucent margins; seventh metasomal sternum of male produced back as slender neck to which apical lobes are attached *Goniocolletes*
 Facial foveae not impressed; stigma usually not parallel sided, more than half as long as that part of marginal cell on wing margin (except in *subpunctatus*); metasomal terga without basal hair bands, apical marginal areas rarely broadly translucent; seventh metasomal sternum of male with median portion not so slender and elongate
 *Leioproctus*
Leioproctus ferrisi (Rayment, 1935) (*Paracolletes*), the type of which is in the collection of the Commonwealth Scientific and Industrial Research Organization, cannot be placed in the subgeneric classification. In the key

it runs near *Anacolletes*. Unfortunately the genitalia and hidden sterna were dissected by the describer but are not now attached to the specimen. Therefore the subgeneric placement is uncertain. In the fine, dense punctuation and general appearance this species resembles the subgenera *Andrenopsis* and *Colletellus*, and at least on the basis of the characters of the male, it would run to the latter except for the presence of three submarginal cells.

SUBGENUS **LEIOPROCTUS** SMITH, SENSU STRICTO

Plate 1, figures 3, 4; text figures 26, 27, 32-34, 48, 59-82, 86-89

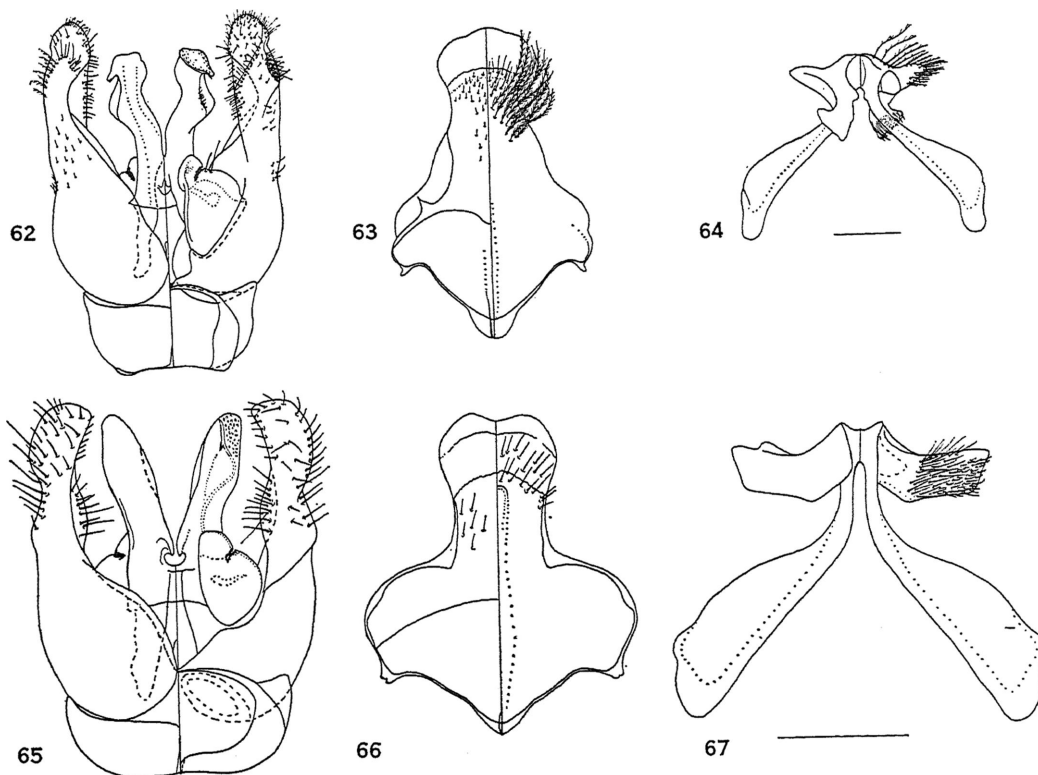
Leioproctus SMITH, 1853, p. 8. Type: *Leioproctus imitatus* Smith, 1853 (by designation of Cockerell, 1905a, p. 348).

Lamprocolletes SMITH, 1853, p. 10. Type: *Andrena chalybeata* Erickson, 1851 (by designation of Cockerell, 1905a, p. 344).

Dasycolletes SMITH, 1853, p. 14. Type: *Dasycolletes metallicus* Smith, 1853 (by designation of Cockerell, 1905a, p. 347).

Heterocolletes RAYMENT, 1935, p. 184. Type: *Paracolletes capillatus* Rayment, 1935 (original designation). New synonymy.

Facial fovea absent or represented by shining or smooth area, not impressed; scape usually reaching median ocellus; three submarginal cells (see *abnormis*); stigma usually not parallel sided, usually more than half as long as costal part of marginal cell, scarcely more than half as long in *advena* (= *euphenax*) and *worsfoldi*, less than half as long in *subpunctatus*; jugal lobe usually attaining or surpassing cu-v and about two-thirds as long as vannal lobe (in *advena*, *worsfoldi*, and a few others, about half as long as vannal lobe; in *rudis* and *opaculus* little more than one-fourth as long as vannal lobe), metanotum usually not tuberculate, rarely with small median tubercle (e.g., in *insularis*); *propodeum* in profile with subhorizontal basal zone, occasionally separated from vertical part by a carina but usually not, in some cases considerably sloping, and merging with vertical



FIGS. 62-67. Male genitalia and eighth and seventh sterna of Colletinae. 62-64. *Leioproctus* (*Leioproctus*) *insularis*. 65-67. *L. (L.) lanhami*. Scale lines represent 0.25 mm.

surface, subhorizontal zone longer than to nearly as long as metanotum, distinctly shorter in some of *platycephalus* group; inner hind tibial spur usually pectinate, ciliate in *metallicus* group and in *subpunctatus*; metasoma usually without hair bands, usually weakly punctured; seventh metasomal sternum with two apical lobes (except as indicated in paragraph 5 below); gonostyli typically large, broad, indistinguishably fused to gonocoxites.

This large subgenus contains the bulk of the species of the genus. In most species the males are elongate, with long antennae. While a great many of them are morphologically monotonously similar, divergent lines containing relatively few species have become very different from the bulk of the subgenus. Many are sufficiently differentiated to be regarded as separate subgenera, but anecdotal species or insufficient data, or the conviction that the differences listed are not numerous enough to be of subgeneric value, have led me to regard the following as divergent groups of *Leioproctus*, *sensu stricto*, rather than as separate subgenera:

1. Some small rather robust forms may represent the style of bee from which *Microcolletes* arose.

2. In scattered unrelated species the stigma becomes slender and nearly parallel sided, as is also true of such forms as *rhodopus*, *capillatus*, *megachalcoides*, *sexmaculatus*, *cinereus*, and the group referred to under 5 below. In the last group it is also short as in *Goniocolletes*.

3. Some species (*insularis*, *rhodopus*, *sexmaculatus*, *cinereus*) with a median tubercle on the metanotum may resemble the stock or stocks from which *Nodocolletes* arose. See the discussion under that subgenus.

4. In a small group of species the first recurrent vein is well beyond the middle of the second submarginal cell; the jugal lobe is short, not reaching cu-v; the basitibial plate is unusually large (not in *rubellus*), and a carina often separates the horizontal from the dorsal surfaces of the propodeum. Each of these characters is found alone in other unrelated species, but their association seems to indicate a phyletic line. In this line, reduction of the inner tooth of the tarsal claws of the female is noteworthy; in *maculatus* and *rubel-*

lus the claws are cleft as usual in the genus, in *unguidentata* the inner tooth is much reduced, and in *truncatulus* and *platycephalus* the claws are simple.

5. In some species, most of which have apical tergal hair bands, the jugal lobe is short, not attaining cu-v, the stigma is little more than half as long as the costal edge of the marginal cell, and the basitibial plate is small. These species may not all be closely related phylogenetically. However, in the only two species of which the males have been dissected (*euphenax*=*advena* and *ruficornis*) the seventh sternum has four distinct apical lobes instead of two as occur elsewhere in the subgenus. Probably, as further knowledge is gained, this group or part of it will warrant subgeneric status.

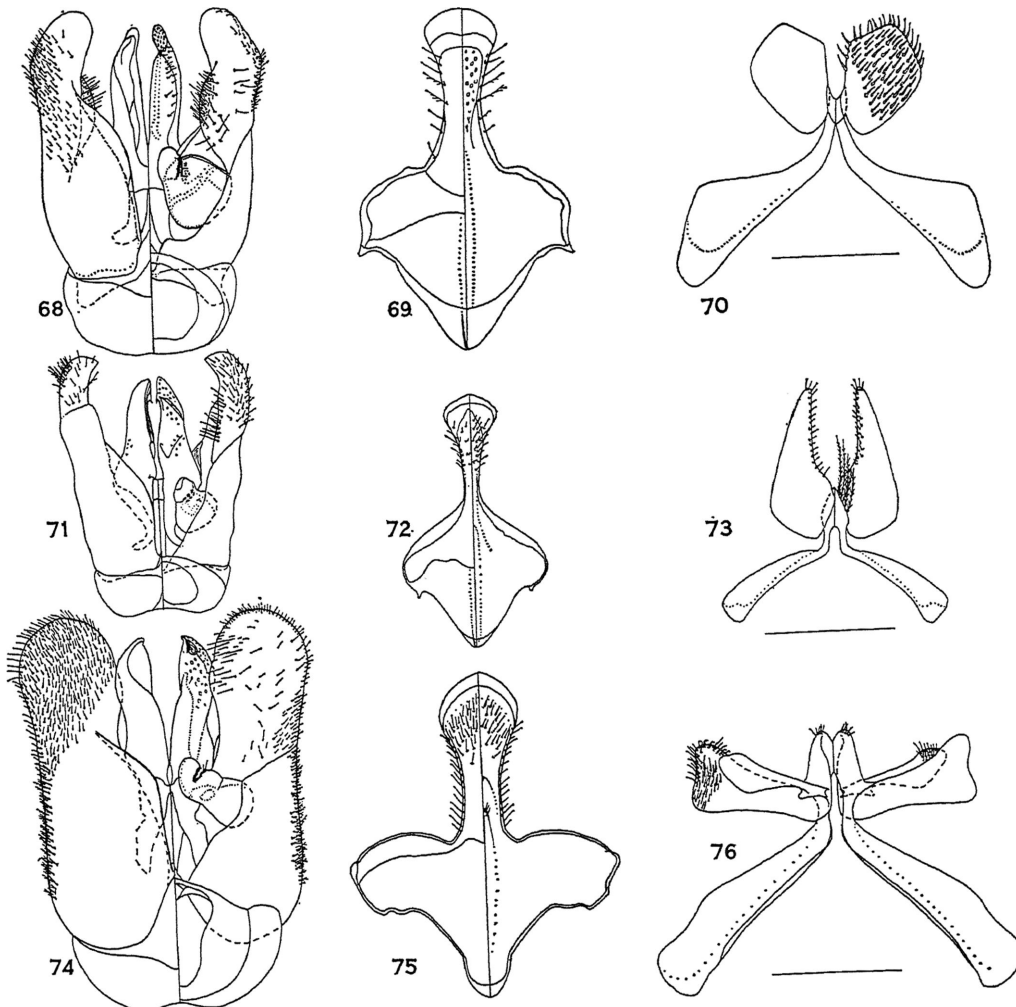
6. In a few species the eyes are hairy. This is true of *nigriventris* Friese, a very ordinary-appearing species usually identified as *thornleighensis* (the type of *thornleighensis* has bare eyes). It is also true of *capillatus* which has been made the type of a subgenus, *Heterocolletes*, partly because of the hairy genitalia. Equally hairy genitalia occur in certain other species with bare eyes, and to me *capillatus* seems to fall well within the range of variation of *Leioproctus*, *sensu stricto*, with respect to the total spectrum of its characters.

7. The species *apicalis* is unusual in having the tibial scopa sparse and consisting of simple rather than plumose hairs. The basitibial plate is more than one-fourth as long as the tibia.

8. See the discussion of *abnormis* under *Euryglossidia*.

9. In a substantial group of species (the *metallicus* group) the inner hind tibial spur of the female is ciliate more or less as illustrated for the subgenus *Nesocolletes* rather than pectinate as in the rest. It was tempting to regard this group as a separate subgenus, since the spur is often an important character among bees. However, no other character correlated with the spur could be found, and it therefore seems clear that subgeneric status is unwarranted. Forms with the pectinate spur could be called *Lamprocolletes* by anyone wishing to separate the group.

The *metallicus* group consists of species superficially resembling ordinary *Leioproctus*, *sensu stricto*. They are black or weakly metal-



FIGS. 68-76. Male genitalia and eighth and seventh sterna of Colletinae. 68-70. *Leioproctus* (*Leioproctus*) *metallicus*. 71-73. *L. (L.) papuanus*. 74-76. *L. (L.) advena*. Scale lines represent 0.5 mm.

lic and mostly of moderate size, although *maritimus* and *nicholsoni* are small, as is *Microcolletes*. The occurrence of the group in New Zealand and Western Australia, and its absence from eastern Australia, seem to suggest that it is a relict group replaced in eastern Australia by forms with pectinate spurs; the latter also occur in Western Australia but have not reached New Zealand. As discussed under the generic heading, there is some intergradation or approach to it between ciliate and pectinate spurs, but the more or less intermediate species can almost always be

placed in one group or the other without hesitation.

10. Another species with the inner hind tibial spur of the female ciliate (it is ciliate medially but finely serrate basally and apically) is *subpunctatus*. It is for this reason listed with the *metallicus* group, but it could have been put in a separate subgenus because of the following characters: scape of female not reaching anterior ocellus; stigma short, less than half as long as part of marginal cell on costal edge of wing; basitibial plate of female small, less than one-fourth as long as tibia.

The general appearance, the apical pale fasciae of hair on the metasomal terga, and the wing characters listed above suggest group 5, but the jugal lobe reaches beyond cu-v, the stigma is not slender as in that group, and of course the tibial spur is entirely different. The terminalia of the male are also distinctive, as shown in the figures.

DISTRIBUTION: Tasmania, Australia north to northern Queensland, Lord Howe Island, New Guinea, and Misool. The *metallicus* group also occurs in New Zealand, and in Australia is limited to the southwest part of the continent.

INCLUDED SPECIES

Those marked *a* belong to the *platycephalus* group discussed in paragraph 4 above; those marked *b* belong to the *advena* group discussed in paragraph 5 above, and those marked *c* belong to the *metallicus* group and are discussed in paragraphs 9 and 10 above.

- Leioproctus* (*Leioproctus*) *abnormis* (Cockerell, 1916c) (*Paracolletes*) n. comb. (B.M.)
- (b) *advena* (Smith, 1862a) (*Andrena*) n. comb. (B.M.)
- alienus* (Smith, 1853) (*Andrena*) n. comb. (B.M.)¹
- alleynae* (Rayment, 1935) (*Paracolletes*) n. comb. (C.S.I.R.O.)
- amabilis* (Smith, 1879) (*Lamprocolletes*) n. comb. (B.M.)
- apicalis* (Cockerell, 1921) (*Paracolletes*) n. comb. (Q.M.)
- atroniens* (Cockerell, 1914f) (*Paracolletes*) n. comb. (B.M.)
- bacchalis* (Cockerell, 1914c) (*Paracolletes*) n. comb. (B.M.)
- bicristatus* (Cockerell, 1929d) (*Paracolletes*) n. comb. (Q.M.)
- bicolor* (Smith, 1879) (*Lamprocolletes*) n. comb. (B.M.)
- (c) *boltoni* (Cockerell, 1904b) (*Paracolletes*) n. comb. (B.M.) New Zealand
- boroniae* (Cockerell, 1921) (*Paracolletes*) n. comb. (Q.M.)
- caerulescens* (Cockerell, 1929b) (*Paracolletes*) n. comb. (A.M.N.H.). Preoccupied by *Pasiphae caerulescens* Spinola, 1851, transferred to *Leioproctus* with *Spinolapis* but probably not a valid taxon, hence not renamed

¹ This species has been listed as a North American *Andrena*. I am indebted to Dr. T. B. Mitchell who called my attention to it. It is similar to *L. confusus* but not the same species.

- capillatus* (Rayment, 1935) (*Paracolletes*) n. comb. (C.S.I.R.O.)
- carinatus* (Smith, 1853) (*Lamprocolletes*) n. comb. (B.M.)
- carinatus* (Cockerell, 1905f) (*Paracolletes*) n. comb. (B.M.)
- castaneipes* (Cockerell, 1914f) (*Paracolletes*) n. comb. (B.M.)
- chalcurus* (Cockerell, 1921) (*Paracolletes*) n. comb. (Q.M.)
- chalybeatus* (Erichson, 1842) (*Andrena*) n. comb.
- cinereus* (Smith, 1853) (*Lamprocolletes*) n. comb. (B.M.)
- clarki* (Cockerell, 1929d) (*Paracolletes*) n. comb. (desc.)
- confusus* (Cockerell, 1904b) (*Paracolletes*) n. comb. (B.M.). Described as from New Zealand, but "N. Holl." is on label on type; undoubtedly Australian, to judge by pectinate spur as well as label
- cristatus* (Smith, 1853) (*Lamprocolletes*) n. comb. (Ox.)
- cupreus* (Smith, 1853) (*Lamprocolletes*) n. comb. (B.M.)
- (a) *cyaneorufus* (Cockerell, 1930b) (*Paracolletes*) n. comb. (Q.M.)
- cyanurus* (Cockerell, 1914c) (*Paracolletes*) n. comb. (B.M.)
- eucalypti* (Cockerell, 1916c) (*Paracolletes*) n. comb. (Q.M.)
- (b) *euphenax* (Cockerell, 1913d) (*Paracolletes*) n. comb. (Q.M.)
- facialis* (Cockerell, 1921) (*Paracolletes*) n. comb. (Q.M.)
- fervidus* (Friese, 1924, not Smith, 1879) (*Paracolletes*) n. comb. Homonym of *P. fervidus* Smith but not renamed because synonym of *friesellus*
- festivus* (Cockerell, 1929b) (*Paracolletes*) n. comb. (A.M.N.H.)
- flavomaculatus* (Cockerell, 1905f) (*Paracolletes*) n. comb. (B.M.)
- frankiellus* Michener, new name for *Paracolletes franki* Cockerell, 1929b, Amer. Mus. Novitates, no. 343, p. 5, not *Bicolletes franki* Friese, 1908, here transferred to *Leioproctus* (A.M.N.H.)
- frenchi* (Cockerell, 1929b) (*Paracolletes*) n. comb. (B.M.)
- friesellus* Michener, new name for *Paracolletes friesei* Cockerell, 1929d, Mem. Queensland. Mus., vol. 9, p. 306, not *Bicolletes friesei* Ducke, 1912, here transferred to *Leioproctus* (Q.M.)
- hackeri* (Cockerell, 1918b) (*Paracolletes*) n. comb. (Q.M.)

- hardyi* (Cockerell, 1929d) (*Paracolletes*) n. comb. (Q.M.)
- helmsi* (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
- hobartensis* (Cockerell, 1906a) (*Paracolletes*) n. comb. (B.M.)
- (c) *hudsoni* (Cockerell, 1925a) (*Paracolletes*) n. comb. (B.M.) New Zealand
- humerosus* (Smith, 1879) (*Dasycolletes*) n. comb. (B.M.)
- ibex* (Cockerell, 1914c) (*Paracolletes*) n. comb. (B.M.)
- illawarraensis* (Rayment, 1954a) (*Paracolletes*) n. comb. (C.S.I.R.O.)
- (c) *imitatus* Smith, 1853 (B.M.) New Zealand
- incomptus* (Cockerell, 1921) (*Paracolletes*) n. comb. (Q.M.)
- insularis* (Cockerell, 1913d) (*Paracolletes*) n. comb. (Q.M.)
- irroratus* (Smith, 1853) (*Lamprocolletes*) n. comb. (Ox.)
- lanhami* Michener, new species (U.M.) New Guinea
- launcestonensis* (Cockerell, 1914m) (*Paracolletes*) n. comb. (B.M.)
- leai* (Cockerell, 1913b) (*Paracolletes*) n. comb. (U.S.N.M.)
- (a) *maculatus* (Rayment, 1930b) (*Paracolletes*) n. comb. (C.S.I.R.O.; paratypes, B.M., are another species that does not agree with description)
- (c) *maorium* (Cockerell, 1913d) (*Paracolletes*) n. comb. (B.M.) New Zealand
- (c) *maritimus* (Cockerell, 1936) (*Paracolletes*) n. comb. (B.M.) New Zealand
- megachalcoides* Michener, new species (W.A.M.)
- melanoproctus*, new name for *Paracolletes melanurus* Cockerell, 1930b, Mem. Queensland Mus., vol. 10, p. 47, not *Pasiphae cyanea melanura* Cockerell, 1917, here transferred to *Leioproctus* with *Spinolapis* (Q.M.)
- melbournensis* (Cockerell, 1910a) (*Paracolletes*) n. comb. (Berlin*)
- metallescens* (Cockerell, 1914f) (*Paracolletes*) n. comb. (B.M.)
- (c) *metallicus* (Smith, 1853) (*Dasycolletes*) n. comb. (B.M.) New Zealand
- metallicus* (Smith, 1879) (*Lamprocolletes*) n. comb. (B.M.). Preoccupied by *Dasycolletes metallicus* Smith, 1853, but considered by Cockerell as synonym of *amabilis*, hence not renamed
- mimulus* (Cockerell, 1910a) (*Paracolletes*) n. comb. (B.M.)
- minor* (Friese, 1924) (*Lamprocolletes*) n. comb. (desc.)
- moniliformis* (Cockerell, 1916c) (*Paracolletes*) n. comb. (B.M.)
- nanus* (Smith, 1879) (*Lamprocolletes*) n. comb. (B.M.)
- (c) *nicholsoni* (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
- (c) *nigritulus* (Cockerell, 1916c) (*Paracolletes*) n. comb. (B.M.)
- nigriventris* (Friese, 1924) (*Lamprocolletes*) n. comb.
- nigroclypeatus* (Cockerell, 1910a) (*Paracolletes*) n. comb. (B.M.)
- nigrofulvus* (Cockerell, 1914c) (*Paracolletes*) n. comb. (B.M.)
- (a) *nigropurpureus* (Rayment, 1935) (*Paracolletes*) n. comb. (C.S.I.R.O.). Figure and behavior only, no description
- nitidulus* (Cockerell, 1916c) (*Paracolletes*) n. comb. (B.M.)
- nomadiformis* (Cockerell, 1921) (*Paracolletes*) n. comb. (Q.M.)
- obscuripennis* (Cockerell, 1905f) (*Paracolletes*) n. comb. (B.M.)
- obscurus* (Smith, 1853) (*Lamprocolletes*) n. comb. (B.M.)
- (b) *opaculus* (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
- ornatissimus* (Cockerell, 1916d) (*Paracolletes*) n. comb. (B.M.)
- pallidicinctus* (Rayment, 1953a) (*Paracolletes*) n. comb. (C.S.I.R.O.)
- papuanus* Michener, new name for *Nomia chalybaea* Friese, 1909, Ann. Mus. Nat. Hungarici, vol. 7, p. 199, not *Biglossa chalybaea* Friese, 1906, transferred to *Leioproctus* with *Biglossidia* (typus W.) New Guinea
- pavonellus* (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
- (b) *phillipensis* (Rayment, 1953a) (*Paracolletes*) n. comb. (C.S.I.R.O.)
- philonesus* (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
- (a) *platycephalus* (Cockerell, 1912c) (*Paracolletes*) n. comb. (B.M.)
- plebeius* (Cockerell, 1921) (*Paracolletes*) n. comb. (Q.M.)
- plumosellus* (Cockerell, 1905f) (*Paracolletes*) n. comb. (B.M.)
- plumosus* (Smith, 1853) (*Lamprocolletes*) n. comb. (B.M.)
- providellus* (Cockerell, 1905f) (*Paracolletes*) n. comb. (B.M.)
- providus* (Smith, 1879) (*Lamprocolletes*) n. comb. (B.M.)
- punctatus* (Smith, 1853) (*Lamprocolletes*) n. comb. (B.M.)

- punctiventris* (Cockerell, 1929b) (*Paracolletes*) n. comb. (A.M.N.H.)
- (c) *purpureus* (Smith, 1853) (*Dasycolletes*) n. comb. (B.M.) New Zealand
- recusus* (Cockerell, 1921) (*Paracolletes*) n. comb. (Q.M.)
- regalis* (Cockerell, 1921) (*Paracolletes*) n. comb. (Q.M.)
- rhodopus* (Cockerell, 1914f) (*Paracolletes*) n. comb. (B.M.)
- roseoviridis* (Cockerell, 1905h) (*Paracolletes*) n. comb. (B.M.)
- (b) *rudis* (Cockerell, 1906a) (*Paracolletes*) n. comb. (B.M.)
- (a) *rubellus* (Smith, 1862a) (*Dasycolletes*) n. comb. (B.M.)
- (b) *ruficornis* (Smith, 1879) (*Lamprocolletes*) n. comb. (B.M.)
- rufipes* (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
- (a) *rufaeneus* (Friese, 1924) (*Dasycolletes*) n. comb. ("typus" A.M.N.H.)
- scitulus* (Cockerell, 1921) (*Paracolletes*) n. comb. (Q.M.)
- (c) *semilautus* (Cockerell, 1905f) (*Paracolletes*) n. comb. (B.M.)
- semilucens* (Cockerell, 1929d) (*Paracolletes*) n. comb. (Q.M.)
- sempurpureus* (Cockerell, 1905f) (*Paracolletes*) n. comb. (B.M.)
- semiviridis* (Cockerell, 1930b) (*Paracolletes*) n. comb. (Q.M.)
- sexmaculatus* (Cockerell, 1914f) (*Paracolletes*) n. comb. (B.M.)
- sigillatus* (Cockerell, 1914c) (*Paracolletes*) n. comb. (B.M.)
- simulator* Michener, new name for *Paracolletes simillimus* Cockerell, 1916c, Ann. Mag. Nat. Hist., ser. 8, vol. 18, p. 48, not *Euryglossa simillimus* Smith, 1879, now in subgenus *Euryglossidia*; not *Goniocolletes simillimus* Rayment, 1935 (B.M.)
- spatulatus* (Cockerell, 1905f) (*Paracolletes*) n. comb. (B.M.)
- stewarti* (Rayment, 1947a) (*Paracolletes*) n. comb. (C.S.I.R.O.)
- subdulus* (Cockerell, 1913d) (*Paracolletes*) n. comb. (B.M.)
- subminutus* (Rayment, 1934) (*Paracolletes*) n. comb. (C.S.I.R.O.)¹
- (c) *subpunctatus* (Rayment, 1935) (*Paracolletes*) n. comb. (C.S.I.R.O.)
- subviridis* (Cockerell, 1915e) (*Paracolletes*) n. comb. (B.M.)

¹ This species is placed here with hesitation. The thorax of the type is crushed and the hind tibiae are both missing so that many important characters cannot be verified.

- thornleighensis* (Cockerell, 1906a) (*Paracolletes*) n. comb. (B.M.)
- (a) *truncatulus* (Cockerell, 1913d) (*Paracolletes*) n. comb. (Q.M.)
- (a) *unguidentatus* Michener, new species (C.S.I.R.O.)
- versicolor* (Smith, 1853) (*Lamprocolletes*) n. comb. (B.M.)
- (c) *vestitus* (Smith, 1876) (*Paracolletes*) n. comb. (B.M.)
- (c) *viridibasis* (Cockerell, 1936) (*Paracolletes*) n. comb. (B.M.) New Zealand
- viridicinctus* (Cockerell, 1905f) (*Paracolletes*) n. comb. (B.M.)
- (b) *worsfoldi* (Cockerell, 1906a) (*Paracolletes*) n. comb. (B.M.)

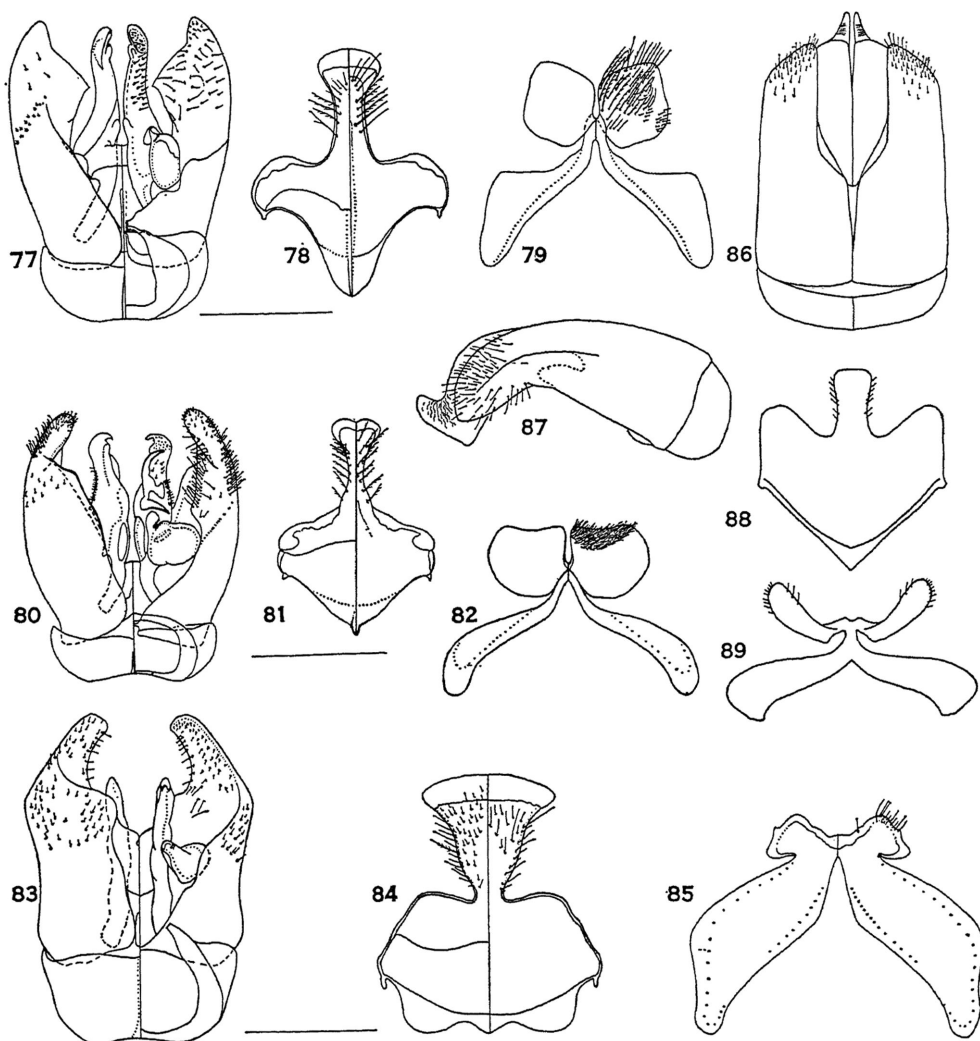
NESOCOLLETES, NEW SUBGENUS

Plate 1, figure 5; text figures 35, 49, 83-85

TYPE: *Lamprocolletes fulvescens* Smith, 1876.

This subgenus, found only in New Zealand, is related to *Leioproctus* proper (*metallicus* group), although in general it is more slender and has more long erect pubescence. Its most distinctive external feature, almost unique among species of *Leioproctus*, is the long malar space, more than half as long as the width of the base of the mandible. A feature that emphasizes its distinctness from *Leioproctus*, *sensu stricto*, is the seventh metasomal sternum of the male, which, instead of having moderate-sized to large apical lobes, has these lobes minute and broadly attached to the apex of the sternum.

Body rather elongate, with long hair; facial fovea not or scarcely recognizable; apex of scape reaching median ocellus; flagellum of male with median segments about 1.5 times as long as broad; clypeus slightly convex in profile, moderately protuberant, half below lower ends of eyes; malar space more than half as long as basal width of mandible; antennae arising above middle of face; epistomal suture distinct; three submarginal cells; stigma slender, not parallel sided, more than half as long as costal side of marginal cell; jugal lobe of hind wing not approaching cu-v, only half as long as vannal lobe; head and thorax rather strongly punctate, metasoma minutely roughened, scarcely punctate; propodeal triangle with basal part steeply sloping, shorter than metanotum, rounding onto subvertical part, basal part so steep that whole profile can be described as subvertical or steeply sloping; inner



FIGS. 77-89. Male genitalia and eighth and seventh sterna of Colletinae. 77-79. *Leioproctus* (*Leioproctus*) *truncatulus*. 80-82. *L. (L.) semipurpureus*. 83-85. *L. (Nesocolletes) fulvescens*. Scale lines represent 0.5 mm. 86-89. Sketches from dry material of dorsal and lateral views of male genitalia and eighth and seventh sterna of *L. (Leioproctus) subpunctatus*.

hind tibial spur of female finely ciliate; margins of metasomal terga broadly translucent and slightly depressed; pygidial plate of male represented by longitudinal bare area on seventh tergum, not delimited laterally by carinae; seventh sternum of male with apical lobes small and broadly attached to rest of sternum.

DISTRIBUTION: New Zealand.

INCLUDED SPECIES

Leioproctus (*Nesocolletes*) *fulvescens* (Smith, 1876)

(*Lamprocolletes*) n. comb. (B.M.) New Zealand
hirtipes (Smith, 1878) (*Dasycolletes*) n. comb. (B.M.) New Zealand
monticola (Cockerell, 1925a) (*Paracolletes*) n. comb. (B.M.) New Zealand
opacior (Cockerell, 1936) (*Paracolletes*) n. comb. (B.M.) New Zealand
waterhousei Cockerell, 1905a (*Paracolletes*) n. comb. (B.M.) New Zealand

The name *waterhousei* was based on a spec-

imen assumed, presumably in error, to be from Australia (see also Cockerell, 1926b).

SUBGENUS CLADOCERAPIS COCKERELL

Plate 1, figures 6, 7; text figures 90-95

Cladocerapis COCKERELL, 1904d, p. 292. Type: *Lamprocolletes cladocerus* Smith, 1862 = *bipectinatus* Smith, 1856 (monobasic and original designation).

This subgenus is closely related to *Leioproctus*, *sensu stricto*, with which it agrees in appearance, differing by the characters italicized below. The species of *Cladocerapis* are not metallic. It is a well-marked little group, yet contains species that have not hitherto been segregated from the bulk of *Leioproctus*. Of particular interest is *P. (C.) incanescens* in which the sparsely punctured clypeus and supraclypeal area are suggestive of some *Leioproctus*.

The name *Cladocerapis* was originally proposed as a genus for the species *bipectinatus* Smith, because of its fantastic male antennae. Rayment correctly included closely related species having normal antennae.

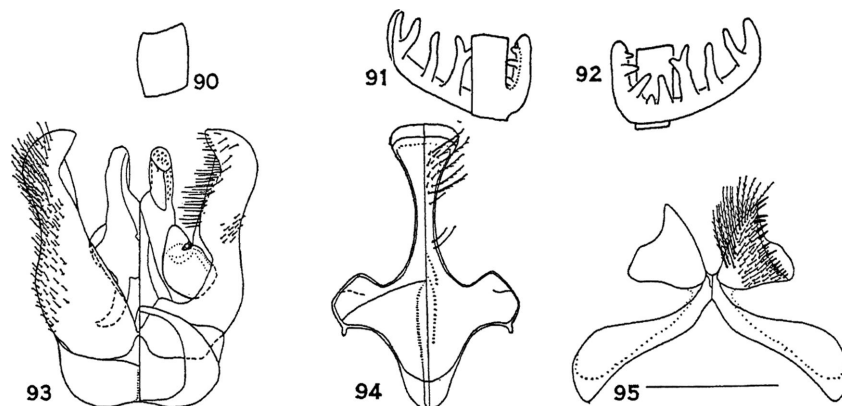
Facial fovea absent; *clypeus and supraclypeal area flat, at least partly smooth, shining and impunctate, suture between them weak*; scape reaching median ocellus; three submarginal cells; stigma rather large, not parallel sided (long but parallel sided in *persooniae*), more than half of length of costal part of

marginal cell; jugal lobe reaching cu-v; metanotum not tuberculate; propodeum in profile with horizontal surface usually as long as metanotum, usually not delimited but curving down to vertical surface; inner hind tibial spur pectinate; claws of female cleft; *fore basitarsus with long, coarse bristles on outer surface*; metasoma without hair bands, weakly punctured.

DISTRIBUTION: Victoria to southern Queensland and southwest Australia. Apparently restricted in pollen gathering to flowers of *Persoonia*.

INCLUDED SPECIES

- Leioproctus (Cladocerapis) bipectinatus* (Smith, 1856) (*Lamprocolletes*) n. comb. = *Lamprocolletes cladocerus* Smith, 1862a (B.M., same specimen type of both names)
carinatifrons (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
colmani (Rayment, 1950a) (*Cladocerapis*) n. comb. (C.S.I.R.O.)
clypeatus (Cockerell, 1916c) (*Paracolletes*) n. comb. (B.M.)
goraeensis (Rayment, 1953a) (*Cladocerapis*) n. comb. (C.S.I.R.O.)
hackeri (Rayment, 1950a) (*Cladocerapis*) n. comb., not *Paracolletes hackeri* Cockerell, 1918, which is a *Leioproctus, sensu stricto* (C.S.I.R.O.). Rayment's name is presumed to be a synonym of *speculiferus*; therefore it is not replaced even though preoccupied
heronii (Rayment, 1935) (*Cladocerapis*) n. comb. (C.S.I.R.O.)



FIGS. 90-95. Colletinae. 90. Seventh flagellar segment of male of *Leioproctus (Cladocerapis) incanescens*. 91. Outer view of seventh flagellar segment of male of *L. (C.) bipectinatus*. 92. Inner view of same. 93-95. Male genitalia and eighth and seventh sterna of *L. (C.) incanescens* (scale line represents 0.5 mm.).

- incanescens* (Cockerell, 1913d) (*Paracolletes*) n. comb. (Q.M.)
perpolitus (Cockerell, 1916c) (*Paracolletes*) n. comb. (B.M.)
persooniae (Rayment, 1950a) (*Cladocerapis*) n. comb. (C.S.I.R.O.)
raymenti Michener, new name for *Cladocerapis plumosus* Rayment, 1935, A cluster of bees, p. 688, not *Lamprocolletes plumosus* Smith, 1853 (C.S.I.R.O.)
speculiferus (Cockerell, 1921) (*Paracolletes*) n. comb. (Q.M.)
woyensis (Rayment, 1935) (*Cladocerapis*) n. comb. (C.S.I.R.O.)

MICROCOLLETES, NEW SUBGENUS

Plate 1, figures 8–11; text figures 38, 50, 96–101

TYPE: *Paracolletes halictiformis* Cockerell, 1916 = *Leioproctus halictomimus* Michener, new name.

This subgenus contains small, completely nonmetallic forms, males of which have the body robust, like that of the female, and short antennae. A few species (*finkei*) have the metasoma red. The subgenus is related to *Leioproctus*, *sensu stricto*, and grades into it in most characters. A few small species of that group have antennae similar to those of *Microcolletes*. In general, however, the small species of *Leioproctus*, *sensu stricto*, differ strikingly from *Microcolletes* in the long antennae of the males. As with *Nodocolletes*, most of the characters of *Microcolletes* are duplicated individually in one or another species of *Leioproctus* proper, but the combination is diagnostic for *Microcolletes*.

Facial fovea impressed or represented by smooth but not depressed area; *scape usually not reaching median ocellus, flagellum short in both sexes*, second and third segments usually much wider than long, and median segments, even in male, little if any longer than wide; clypeus rather flat, little protuberant; epistomal suture visible; three submarginal cells; stigma of moderate size, not parallel sided, more than half as long as costal margin of marginal cell; jugal lobe attaining or surpassing cu-v; body strongly punctate or metasoma weakly so; metanotum with or without small median tubercle; *propodeum in profile entirely declivous or with short horizontal basal area*, shorter than metanotum, and in some cases set off from vertical surface by distinct angle; inner hind tibial spur of female pec-

minate; claws of female cleft; metasoma in some with apical hair bands; seventh sternum of male with a pair of large, posterolaterally directed lobes.

Certain species included in the list below are placed only very tentatively. *Leioproctus fallax* has a pygidial plate which is constricted medially, thus suggesting the subgenus *Excolletes*. *Leioproctus albobittatus* is less densely punctate than are most *Microcolletes*, and has the inner tooth of the tarsal claw unusually small.

Leioproctus tropicalis is unknown in the female. It agrees with *Microcolletes* in most characters but has the dorsal surface of the propodeum slightly longer than the metanotum, which is not at all tuberculate. It is peculiar in the slightly thickened hind tibia and basitarsus, the former with an obtuse ventral angle before the middle, the latter with a strong basal ventral angle. The hind distitarsus is unusually broad and flat.

DISTRIBUTION: Australia, especially abundant in dry areas, known north to central Queensland and to Melville Island (*tropicalis*).

INCLUDED SPECIES

- Leioproctus (Microcolletes) albobittatus* (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
fallax (Cockerell, 1921) (*Paracolletes*) n. comb. (Q.M.)
finkei Michener, new species (C.S.I.R.O.)
halictomimus Michener, new name for *Paracolletes halictiformis* Cockerell, 1916e, Proc. Acad. Nat. Sci. Philadelphia, p. 365, not *Euryglossa halictiformis* Smith, 1879, here transferred to *Leioproctus* with *Euryglossidia* (B.M.)
helichrysi (Cockerell, 1918b) (*Paracolletes*) n. comb. (B.M.)
microsomus Michener, new species (C.S.I.R.O.)
minutus (Cockerell, 1916c) (*Paracolletes*) n. comb. (B.M.)
minutus (Fries, 1924) (*Lamprocolletes*) n. comb. (desc.). Homonym of *minutus* Cockerell, 1916c, but not renamed because a synonym of *perminutus* Cockerell, 1929b
nomiaeformis (Cockerell, 1930b) (*Paracolletes*) n. comb. (Q.M.)
perminutus (Cockerell, 1929b) (*Paracolletes*) n. comb. (A.M.N.H.)
pusillus (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
rudissimus (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)

tropicalis (Cockerell, 1929a) (*Paracolletes*) n. comb. (A.M.N.H.)
wahlenbergiae Michener, new species (C.S.-I.R.O.)

SUBGENUS PROTOMORPHA RAYMENT

Text figures 28, 105-107

Protomorpha RAYMENT, 1959b, p. 334. Type: *Protomorpha tarsalis* Rayment, 1959 (monobasic and original designation).

This subgenus is known from a single male specimen. Although originally considered a distinct genus, *Protomorpha* is an aberrant member of the *Leioproctus* group and as such is here reduced to subgeneric status. In its general aspect, including the nonmetallic body and strong punctation, *Protomorpha* resembles a rather large species of *Microcolletes*. The italicized characters below differentiate *Protomorpha* clearly.

Facial fovea represented by narrow shining depression (male); *scape not reaching median ocellus but flagellum (male) long*, first two segments broader than long but other segments one and one-half times as long as broad or longer; head closely punctate, epistomal suture invisible or nearly so, subantennal suture slightly longer than diameter of antennal socket; three submarginal cells; stigma of moderate size, more than half as long as costal margin of marginal cell; jugal lobe surpassing cu-v; metanotum with weak median tubercle; metanotum and sides of thorax, including propodeum except triangle, closely punctate; scutum and scutellum with punctures coarser and sparser; *propodeum in profile with subhorizontal basal zone shorter than metanotum and separated medially from vertical part by carina*, triangle areolate except for lower posterior portion; *hind tibia and basitarsus broadened as shown in figure, only one hind tibial spur* (male); middle basitarsus and mediotarsus broad, the basitarsus longer than rest of tarsus; metasomal terga densely punctate, bases of terga and broad, apical, nearly translucent margins depressed, terga with apical hair bands; third and especially fourth and fifth sterna (male) narrow, largely hidden, apical margins broadly procurved, apical fringes long, especially on fifth; sixth sternum (male) large, broadly exposed, bluntly pointed apically, with longitudinal depression in apical half; seventh sternum (male) with large

and complex apical lobes; eighth sternum with simple median process.

Unfortunately the mouthparts and male genitalia were dissected out of the specimen by the describer and were evidently lost, so that the characters of these parts can be inferred only from Rayment's sketches.

DISTRIBUTION: New South Wales.

INCLUDED SPECIES

Leioproctus (*Protomorpha*) *tarsalis* (Rayment, 1959b) n. comb. (C.S.I.R.O.)

EXCOLLETES, NEW SUBGENUS

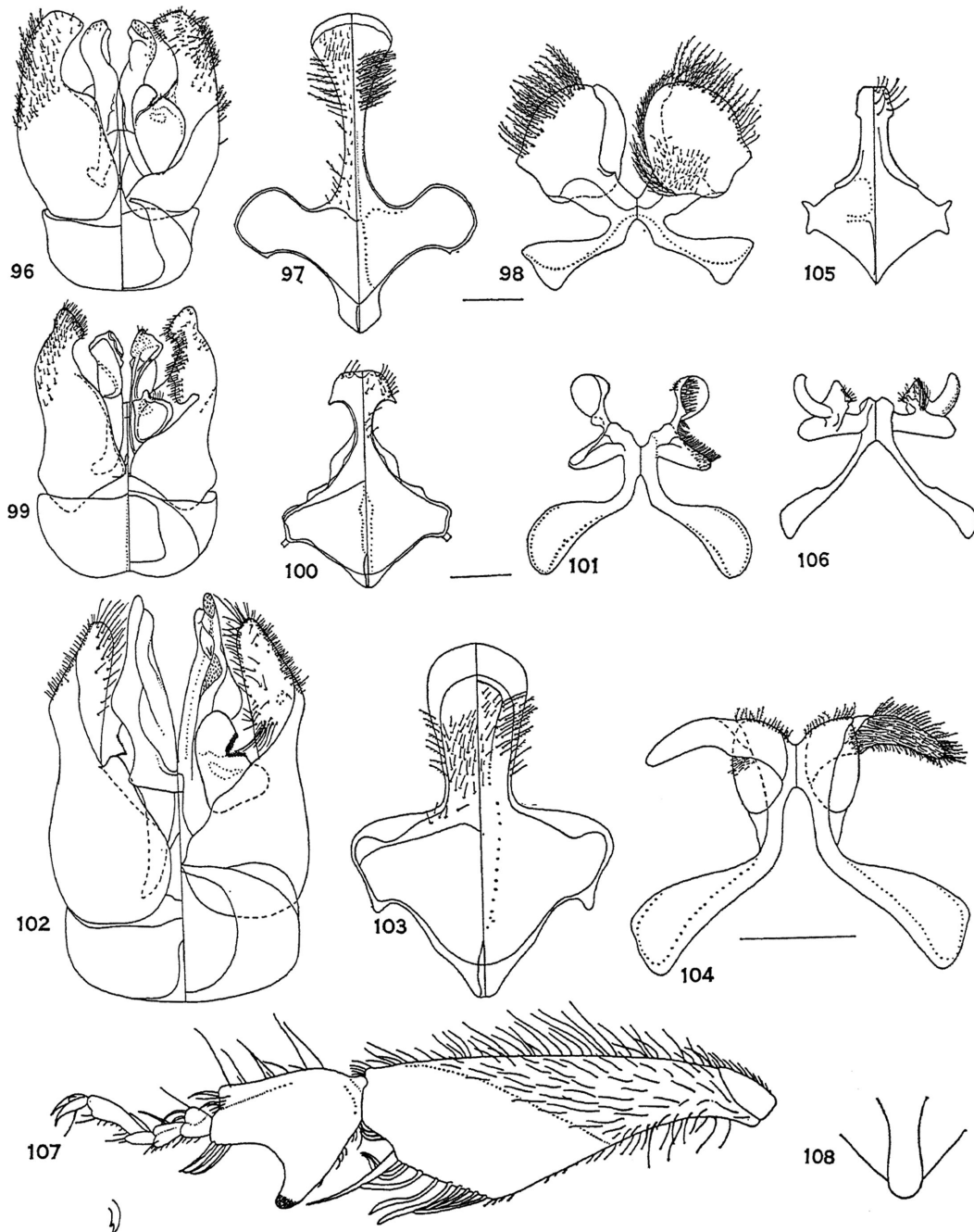
Plate 1, figure 12; plate 2, figure 1; text figures 37, 51, 102-104, 108

TYPE: *Leioproctus impatellatus*, new species.

This subgenus, which is so distinctive that it could well be regarded as a separate genus, contains small, nonmetallic species superficially resembling members of the subgenus *Microcolletes*.

It is remarkable for (1) the complete lack of a basitibial plate in the female (it is present but small in the male), (2) the almost parallel-sided rear part of the pygidial plate in the female (it is a little narrower preapically, so that it is almost spatulate), (3) the nearly transverse basal vein of the forewing, (4) the simple claws in the female, and (5) the low position of the antennal bases and their proximity to the clypeus. Characters 1, 2, and 3 are unique in *Leioproctus*; 4 appears in two unrelated subgenera of *Leioproctus*, and 5 is approached by *L. (Microcolletes) microsomus* and *finkei*. The males are markedly smaller than the females, more noticeably so than in allied bees.

Facial fovea absent (upper limit probably vaguely indicated in female by change in surface texture); *apex of scape not even closely approaching median ocellus*; flagellum of male with median segments about as broad as long; clypeus and supraclypeal areas nearly flat, not protuberant; epistomal suture distinct; *antennae low on face*, in female almost twice as far from vertex as from anterior margin of clypeus, separated from clypeus by only half of diameter of antennal socket in female, by about three-fourths of that distance in male; *basal three-fourths of forewing membrane largely hairless*; three submarginal cells; stigma large, not parallel sided, more than three-



FIGS. 96-108. Colletinae. 96-98. Male genitalia and eighth and seventh sterna of *Leioproctus* (*Microcolletes*) *wahlenbergiae*. 99-101. Same of *L. (M.) halictomimus*. 102-104. Same of *L. (Excolletes)* *impatellatus*. Scale lines represent 0.5 mm. 105, 106. Eighth and seventh sterna of male of *L. (Protomorpha)* *tarsalis*. 107. Right hind tibia and tarsus of male of *L. (P.) tarsalis*, seen in lateral view, with claw in oblique view to show tooth. 108. Dorsum of posterior part of sixth tergum of female *L. (Excolletes)* *impatellatus*.

fifths as long as costal margin of marginal cell; jugal lobe of hind wing considerably exceeding vein cu-v; body finely and sparsely punctate except for coarsely punctate clypeus; propodeal triangle large, smooth, marginal suture pitted only in male; basal horizontal part of propodeal profile more than half of length of vertical part, longer than metanotum, a rather narrowly rounded but not at all carinate separation between the two surfaces; metanotum simple; *claws of female simple; basitibial plate of female entirely absent*, that area covered with hair; *basitibial plate of male clearly defined by carina, as in other subgenera, but small, between one-sixth and one-seventh of length of tibia; inner hind tibial spurs ciliate; front tarsus, on outer surface, with long curved hairs, longer than mediotarsal segments taken together; posterior margins of metasomal terga distinctly and broadly depressed in male, slightly so in female; terga with apical bands of white hair in female; pygidial plate of male not evident, entire dorsal surface of seventh tergum bare and shining, perhaps representing plate; pygidial plate of female with apical part almost parallel sided, somewhat spatulate because slightly narrowed preapically, apex projecting as a process beyond rest of tergum; seventh sternum of male with single pair of apical lateral lobes.*

DISTRIBUTION: New South Wales.

INCLUDED SPECIES

Leioproctus (Excolletes) impatellatus Michener,
new species (C.S.I.R.O.)

COLLETOPSIS, NEW SUBGENUS

Plate 2, figure 2; text figures 42, 54

TYPE: *Leioproctus contrarius*, new species.

This subgenus, known only in the female, contains a single slender black species without metasomal fasciae except at the extreme sides. The protuberant dorsolateral angles of the pronotum are unique in the genus. The large stigma is suggestive of *Leioproctus*, *sensu stricto*, but the essentially vertical propodeal triangle, curious vestiture of the frons and vertex, and other characters separate *Colletopsis* from that subgenus. The continuation of the frontal carina as a ridge extending the length of the supraclypeal area suggests *Ceratocolletes*, but the large stigma and other characters distinguish it.

Facial fovea twice as broad as ocellar diameter, not impressed but recognizable by dull impunctate surface; scape not or scarcely reaching anterior ocellus; clypeus moderately convex, slightly protuberant; *supraclypeal area with strong, shining, longitudinal ridge* (continuation of frontal carina) extending to epistomal suture, which is distinct; subantennal suture extending to tentorial pit, not joining epistomal suture above pit [as in *L. (Ceratocolletes) xenocerata*]; *palpi short*, labial and maxillary palpi subequal in length, about *three-fifths as long as postpalpal part of galea, maxillary palpus with last segment minute so that palpus appears five-segmented; hairs of frons and vertex coarse, not much tapering, simple; dorsolateral angle of pronotum produced as right-angled dorsolateral projection* above level of adjacent part of scutum; three submarginal cells; stigma large, not parallel sided, nearly as long as costal edge of marginal cell; jugal lobe of hind wing attaining cu-v; head, sides of thorax, and metasoma coarsely punctate; dorsum of thorax finely punctate; propodeal triangle nearly smooth, margined by row of pits, profile nearly vertical; metanotum not produced medially but weakly and broadly (transversely) elevated; claws cleft; inner hind tibial spur coarsely pectinate; *tibia slender, scopa consisting of sparse, very long, coarse hairs*, each of which has only one or a few branches; hind trochanter and femur almost without long scopal hairs, anterior face of femur with some downcurved, branched hairs a little longer than femoral diameter; margins of metasomal terga not depressed, without hair bands.

DISTRIBUTION: Western Australia.

INCLUDED SPECIES

Leioproctus (Colletopsis) contrarius Michener,
new species (W.A.M.)

UROCOLLETES, NEW SUBGENUS

Plate 2, figure 3; text figures 40, 53

TYPE: *Leioproctus rhodurus*, new species.

This subgenus is unique among Australian colletids in the absence of arolia. Although this is a striking feature often characteristic of genera among bees, the similarity of *Urocolletes* in other features to various groups of *Leioproctus* indicates that it should be included in *Leioproctus* unless that group is

subdivided. The finely pectinate or ciliate inner hind tibial spur is intermediate between that of the *metallicus* group of *Leioproctus* proper and that of the bulk of that subgenus, and thus this spur resembles that of certain intermediate species discussed under the generic heading *Leioproctus*. The group may well have originated from such forms of *Leioproctus*. Unfortunately the male is unknown.

Facial fovea not or scarcely recognizable, punctate like adjacent areas; scape reaching well beyond lower margin of median ocellus; clypeus rather flat and little produced; epistomal suture distinct; subantennal suture longer than diameter of antennal socket; *anterior margin of median ocellus about midway between antennal bases and posterior edge of vertex*; three submarginal cells; *stigma slender, parallel sided before base of vein r, less than half as long as costal side of marginal cell*; jugal lobe of hind wing nearly reaching level of vein cu-v; body strongly punctate, scutum finely and closely so; propodeal triangle smooth, nearly vertical in profile; metanotum with large, median, rounded, produced portion so that in profile it seems to have a large tooth; claws cleft (female); *arolia absent*; inner hind tibial spur finely pectinate; tergal margins not appreciably depressed.

DISTRIBUTION: Western Australia.

INCLUDED SPECIES

Leioproctus (*Urocolletes*) *rhodurus* Michener, new species (W.A.M.)

ANACOLLETES, NEW SUBGENUS

Plate 2, figures 4, 5; text figures 39, 52, 109-111

TYPE: *Lamprocolletes bimaculatus* Smith, 1879.

This subgenus agrees with most of the major external features of *Microcolletes*, although its species are larger than most species of that subgenus. The really distinctive feature is found in the seventh metasomal sternum of the male, in which the two broad apical lobes found in *Microcolletes* are reduced to mere hairy pads broadly connected to the body of the sternum which therefore does not appear to be that of a colletid bee. *Anacolletes* may be related to *Glossurocolletes*, as is suggested by the rather robust body form of both sexes, the lack of metasomal hair bands, the wing-

venational characteristics, and the reduced seventh sternal lobes, but the simple antennae of the male, unridged supraclypeal area, ordinary eighth sternum of the male, nearly straight and, in the male, ciliate hind tibial spurs, and other characters distinguish *Anacolletes*.

Facial fovea of female broad but undefined on inner and lower margins, of male absent; *scape not reaching median ocellus*; flagellum of male with median segments little if any longer than broad; clypeus slightly to moderately convex and not much protuberant; epistomal suture distinct; subantennal suture about as long as diameter of antennal socket; three submarginal cells; wing venation as in *Glossurocolletes* (second submarginal cell larger in *callurus*); jugal lobe approximately attaining cu-v; head and thorax rather strongly punctate; *propodeal triangle rugose*, with large areolae lateromarginally; *profile of triangle steeply sloping at base, mostly subvertical*; *metanotum with large, blunt, median tubercle*; claws of female cleft; inner hind tibial spur pectinate; metasomal terga rather closely punctured, without appreciably depressed margins in female but those of male somewhat depressed (and punctate); terga without hair bands; pygidial plate of male a rather large bare area, not sharply delimited laterally; seventh metasomal sternum with apical lobes reduced to mere hirsute pads broadly connected to apical part of body of sternum.

DISTRIBUTION: Western Australia.

INCLUDED SPECIES

Leioproctus (*Anacolletes*) *bimaculatus* (Smith, 1879) (*Lamprocolletes*) n. comb. (B.M.)
callurus (Cockerell, 1914f) (*Paracolletes*) n. comb. ("cotype" = paratype B.M.)
nigrior (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
pachyodontus (Cockerell, 1915c) (*Paracolletes*) n. comb. (B.M.)

The inclusion of *callurus* and *nigrior* here is tentative, since their males are unknown to me.

Misunderstanding is likely to result if identified specimens in collections are uncritically accepted as *L. bimaculatus*, for species of the genus *Paracolletes* and of the subgenera *Gonocolletes* and *Leioproctus*, *sensu*

stricto, all carry the name *bimaculatus* in one collection or another.

GLOSSUROCOLLETES, NEW SUBGENUS

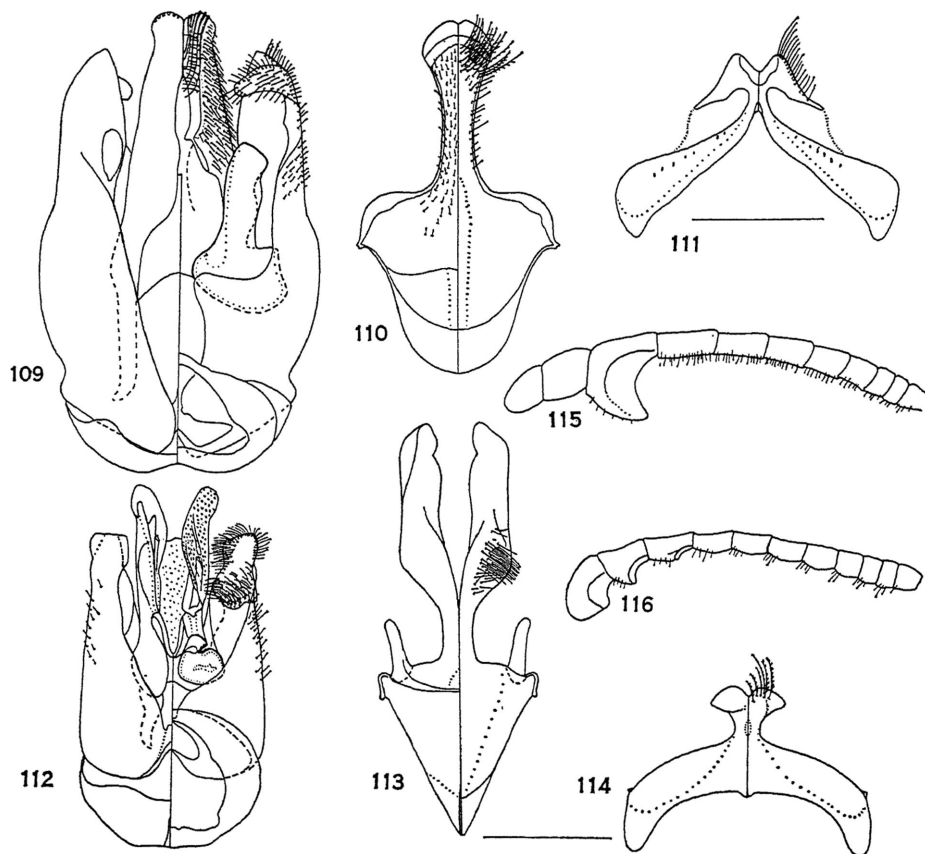
Plate 2, figures 6, 7; text figures 41, 112–116

TYPE: *Leioproctus bilobatus*, new species.

This subgenus, known only in the male, agrees in several major external features with *Microcolletes*, although the species are larger than average for that group and more robust. In these respects, lack of metasomal fasciae, and the reduced apical lobes of the seventh sternum, this subgenus also resembles *Anacolletes*. Noteworthy features of the male of *Glossurocolletes* are the apically modified antennae (differing in type of modification from those of *Ceratocolletes*), the swollen antennal scapes, the broad mandibles (three

times as long as basal width, less than four times as long as minimum width), and the strong longitudinal ridge on the supraclypeal area. The really striking feature of the group, however, is the enormously elongate and biligulate apex of the eighth metasomal sternum of the male. The body form of the male is robust, presumably like that of the unknown female sex.

Facial fovea broad, about three times as long as broad, impunctate, minutely roughened, distinctly impressed; scape not reaching median ocellus or (in *xenoceratus*) nearly reaching it; flagellum (male) with last several segments broad, excavated on under sides; clypeus only moderately protuberant but supraclypeal area with high, longitudinal, median ridge, a continuation of frontal carina, extend-



FIGS. 109–116. Colletinae. 109–111. Male genitalia and eighth and seventh sterna of *Leioproctus* (*Anacolletes*) *bimaculatus*. 112–114. Same of *L.* (*Glossurocolletes*) *bilobatus*. Scale lines represent 0.5 mm. 115. Flagellum of male *L.* (*G.*) *bilobatus*. 116. Same of *L.* (*G.*) *xenoceratus*.

ing nearly to lower end of area; epistomal suture visible; eyes with scattered hairs (very short and inconspicuous in *xenoceratus*); three submarginal cells, second unusually small; stigma small, not parallel sided, vein r arising near middle, length half or somewhat more than half of length of costal side of marginal cell; jugal lobe slightly surpassing cu-v; metanotum slightly elevated medially, in profile appearing tuberculate; hind tibial spurs thick and strongly curved, outer margin of outer spur and inner margin of inner spur pectinate with coarse teeth; middle and hind trochanters (male) each with flat ventral tooth; head and thorax strongly punctate; propodeal triangle largely smooth, steeply sloping (almost subvertical in profile); metasomal terga rather closely punctured although more finely so than thorax; terga without apical fasciae of hair; body of seventh metasomal sternum broad and transverse, like preceding sterna although smaller, with two small free lobes attached to apical margin mesially; eighth sternum with median projection enormously elongated and divided into two broad ligulate lobes, the apices of which are exposed.

DISTRIBUTION: Western Australia.

INCLUDED SPECIES

Leioproctus (*Glossurocolletes*) *bilobatus* Michener,
new species (C.S.I.R.O.)
xenoceratus Michener, new species (W.A.M.)

SUBGENUS NODOCOLLETES RAYMENT

Plate 2, figures 8-10; text figures 30, 117-128

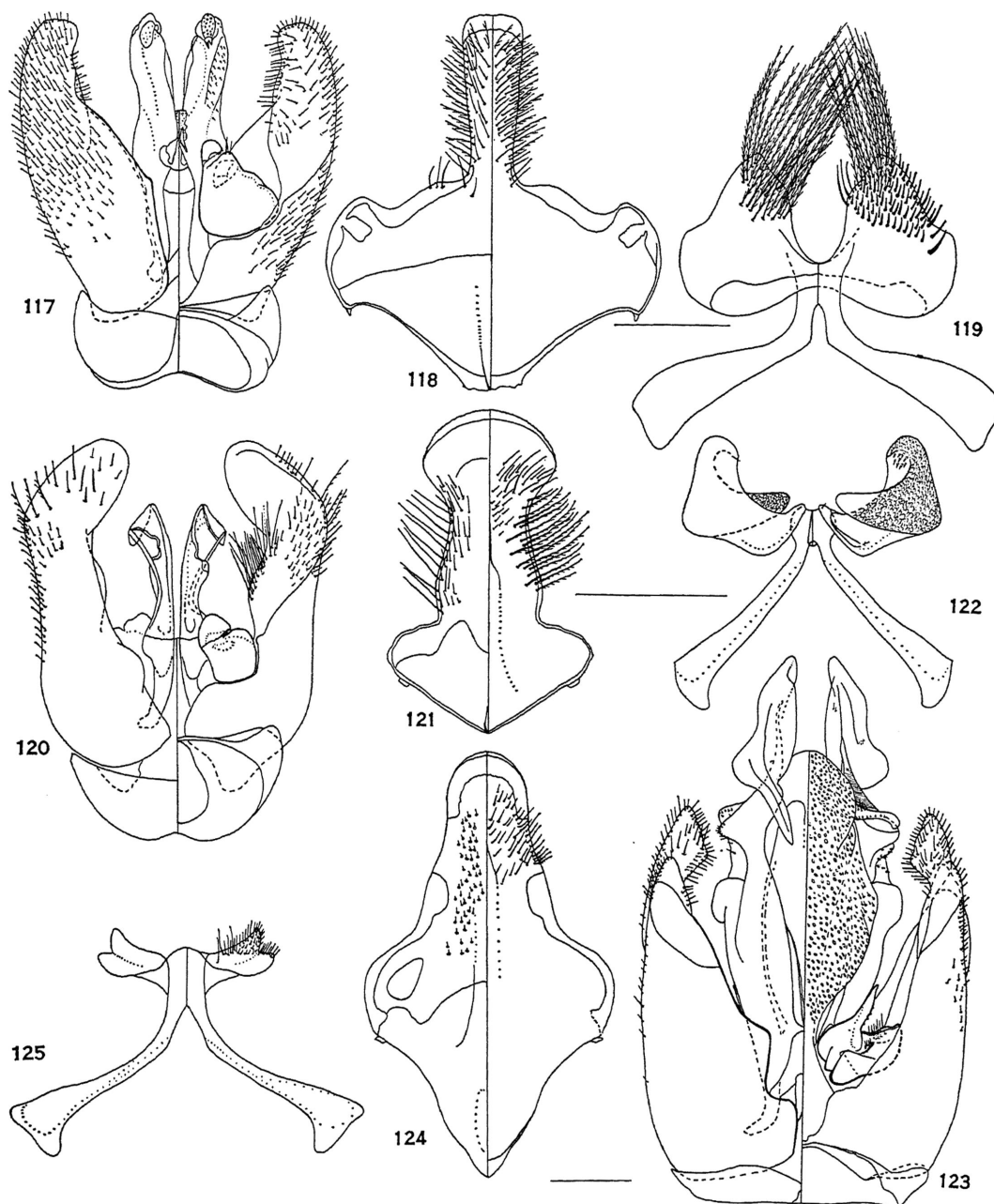
Nodocolletes RAYMENT, 1931b, p. 164. Type: *Nodocolletes dentatus* Rayment, 1931 (original designation).

This subgenus contains moderate-sized to large, usually metallic species that resemble some species (e.g., *carinatus*, *plumosus*) of *Leioproctus*, *sensu stricto*. It differs in general from that subgenus, however, in the characters italicized below.

Facial fovea present or absent; scape reaching median ocellus, flagellum of male with most segments as long as broad to much longer than broad; epistomal suture distinct; three submarginal cells; *stigma slender, parallel sided* or nearly so, about half to nearly two-thirds as long as costal margin of marginal cell; jugal lobe not reaching to exceeding

cu-v; *metanotum with median tubercle, process, spine, or bifid projection* (weak in *fulvus*); head and thorax moderately to strongly punctate; *propodeum in profile steeply sloping to essentially vertical*; inner hind tibial spur of female pectinate; claws of female cleft; metasoma without hair bands, weakly punctured; seventh sternum of male with two apical lobes.

There are species of *Nodocolletes* that are scarcely metallic (*fulvus*) or not metallic (*macrodonatus*, *diadonatus*) but that agree in their other characters with the bulk of species of this subgenus. There are species of *Leioproctus*, *sensu stricto*, that exhibit certain features of *Nodocolletes*. For example, *insularis* has a metanotal tubercle, but the stigma is large and the base of the propodeum broadly subhorizontal. The slender stigma occurs in all intergrading forms. It is very slender and parallel sided in *megachalcoides*, a species that is superficially very like some *Nodocolletes* but lacks the metanotal and propodeal peculiarities of *Nodocolletes*. The species *tuberculatus*, tentatively placed in *Nodocolletes* because of its appearance and metanotal and propodeal structure, has a relatively large stigma like that of some *Leioproctus*, *sensu stricto*. The species *sexmaculatus* is hesitantly placed in *Leioproctus* proper because of its appearance and the white apical hair bands on the metasoma; nevertheless it has a slender stigma, a feeble median metanotal prominence, and a propodeum that is nearly vertical in profile. It seems that, taken independently, the group characters of *Nodocolletes* have all arisen in various groups of *Leioproctus* proper and that their occurrence in combination is the only indication of relationship among the species of *Nodocolletes*. The subgenus *Nodocolletes* as here understood is quite possibly an artificial unit, as is suggested by variation in the male hidden sterna and genitalia. The seventh sternum of the male has only small apical lobes in *dentiger*, large hairy ones in *caeruleotinctus* and *fulvus*. The genitalia are quite different in the three species. Males of more species must be examined before the significance of these characters becomes clear. Facial foveae are more or less distinct and impressed in females and also in males of *megadonatus*, *turneri*, *caeruleotinctus*, *pictus*, *subdentatus*, *elegans*, and *dentiger* and



FIGS. 117-125. Male genitalia and eighth and seventh sterna of Colletinae. 117-119. *Leioproctus* (*Nodocolletes*) *fulvus*. 120-122. *L. (N.) pacificus*. 123-125. *L. (N.) dentiger*. Scale lines represent 0.5 mm.

are absent in other species; no other character was found correlated with this one.

Several and perhaps all of the species have very short, scattered hairs on the eyes; such hairs are most conspicuous in *pacificus*.

Leioproctus dentiger is unique among species of its genus in having the basitibial plate of both sexes defined only along its posterior margin.

DISTRIBUTION: Tasmania and Australia,

north to northern Queensland; New Caledonia.

INCLUDED SPECIES

- Leioproctus* (*Nodocolletes*) *caeruleotinctus* (Cockerell, 1905f) (*Paracolletes*) n. comb. (B.M.)
dentatus (Rayment, 1931b) (*Paracolletes*) n. comb. (W. Agric.)
dentiger (Cockerell, 1910a) (*Paracolletes*) n. comb. (Berlin*)
diodontus (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
elegans Smith, 1853 (B.M.)
fulvus (Smith, 1879) (*Lamprocolletes*) n. comb. (B.M.)
macrodonatus (Rayment, 1935) (*Paracolletes*) n. comb. (C.S.I.R.O.). Head of type missing; placement in this group therefore tentative
megachalceus (Cockerell, 1913h) (*Paracolletes*) n. comb. (B.M.)
megadontus (Cockerell, 1913h) (*Paracolletes*) n. comb. (Q.M.)
pacificus Michener, new species (H.S.P.A.) New Caledonia

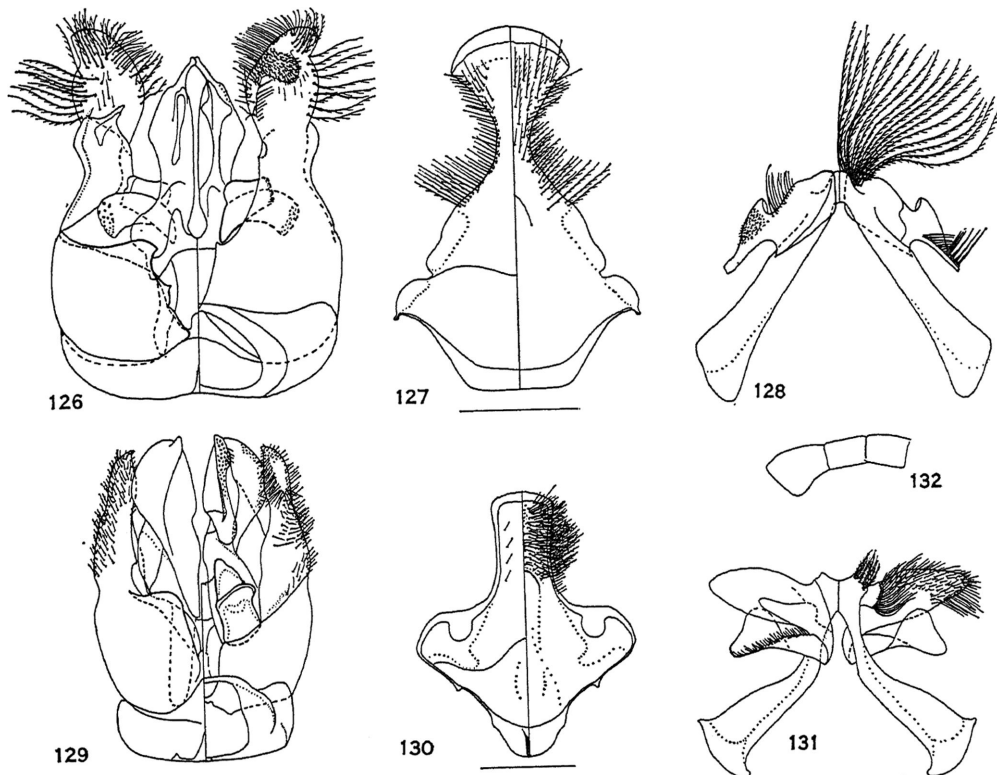
- phanerodontus* (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
pictus (Rayment, 1930b) (*Paracolletes*) n. comb. (C.S.I.R.O.). In *Leioproctus* this is a homonym of *Stenocolletes pictus* Schrottky, 1909, but is not renamed because *pictus* (Rayment) is a synonym of *caeruleotinctus*
subdentatus (Rayment, 1931b) (*Paracolletes*) n. comb. (C.S.I.R.O.)
subvigilans (Cockerell, 1914f) (*Paracolletes*) n. comb. (B.M.)
tuberculatus (Cockerell, 1913d) (*Paracolletes*) n. comb. (U.S.N.M.)
turneri (Cockerell, 1910a) (*Paracolletes*) n. comb. (B.M.)
vigilans Smith, 1879 (B.M.)

CERATOCOLLETES, NEW SUBGENUS

Plate 2, figure 11; text figures 43, 55, 129–132

TYPE: *Lamprocolletes antennatus* Smith, 1879.

This subgenus consists of moderate-sized, rather robust species, with the body form of



FIGS. 126–132. Colletinae. 126–128. Male genitalia and eighth and seventh sterna of *Leioproctus* (*Nodocolletes*) *caeruleotinctus*. 129–131. Same of *L. (Ceratocolletes) antennatus*. Scale lines represent 0.5 mm. 132. Apex of antenna of male of *Leioproctus* (*C.*) *antennatus*.

the male nearly the same as that of the female. The clypeus is medially protuberant and impunctate (except in the male of *andreniformis*). The antenna of the male has the apical segment enlarged. The hind legs, in the male tentatively associated with *andreniformis*, are incrassate, the trochanters toothed, the tibiae bent, the tibial spurs reduced in size, but comparable modifications of the legs do not occur in *antennatus*.

Facial fovea vaguely indicated in female, broad, more finely and sparsely punctate than adjoining areas, but not or scarcely impressed; scape reaching median ocellus; flagellum of male with most or all of segments longer than broad, *last segment enlarged on one side*; clypeus with large impunctate areas and with longitudinal median convexity or protuberance (except in supposed male *andreniformis*); epistomal suture visible; subantennal suture about as long as diameter of antennal socket; three submarginal cells; stigma rather long but slender, parallel sided to vein r, more than half as long as costal margin of marginal cell; jugal lobe nearly attaining to slightly surpassing cu-v; metanotum not tuberculate; head and thorax strongly punctured, with distinct interspaces between punctures; propodeal triangle smooth, shining, sloping basally and gradually curving onto vertical posterior surface, sloping portion shorter than metanotum; *claws of female simple*; inner hind tibial spur of female pectinate; metasomal terga rather finely and, in female, closely punctured, apical margins broadly depressed in male *antennatus*, terga with apical fasciae of white hair (except in supposed male *andreniformis*); pygidial plate of male represented by rather narrow ridge, widening anteriorly, not margined by carinae; *apex of seventh metasomal sternum of male with four laterally projecting lobes* (as in *advena* group of *Leioproctus*, *sensu stricto*).

DISTRIBUTION: Western Australia.

INCLUDED SPECIES

Leioproctus (*Ceratocolletes*) *andreniformis* (Cockerell, 1915b) (*Paracolletes*) n. comb. (B.M.)
antennatus (Smith, 1879) (*Lamprocolletes*) n. comb. (B.M.)

SUBGENUS GONIOCOLLETES COCKERELL

Plate 2, figure 12; plate 3, figures 1, 2; text figures 44, 56, 133-144

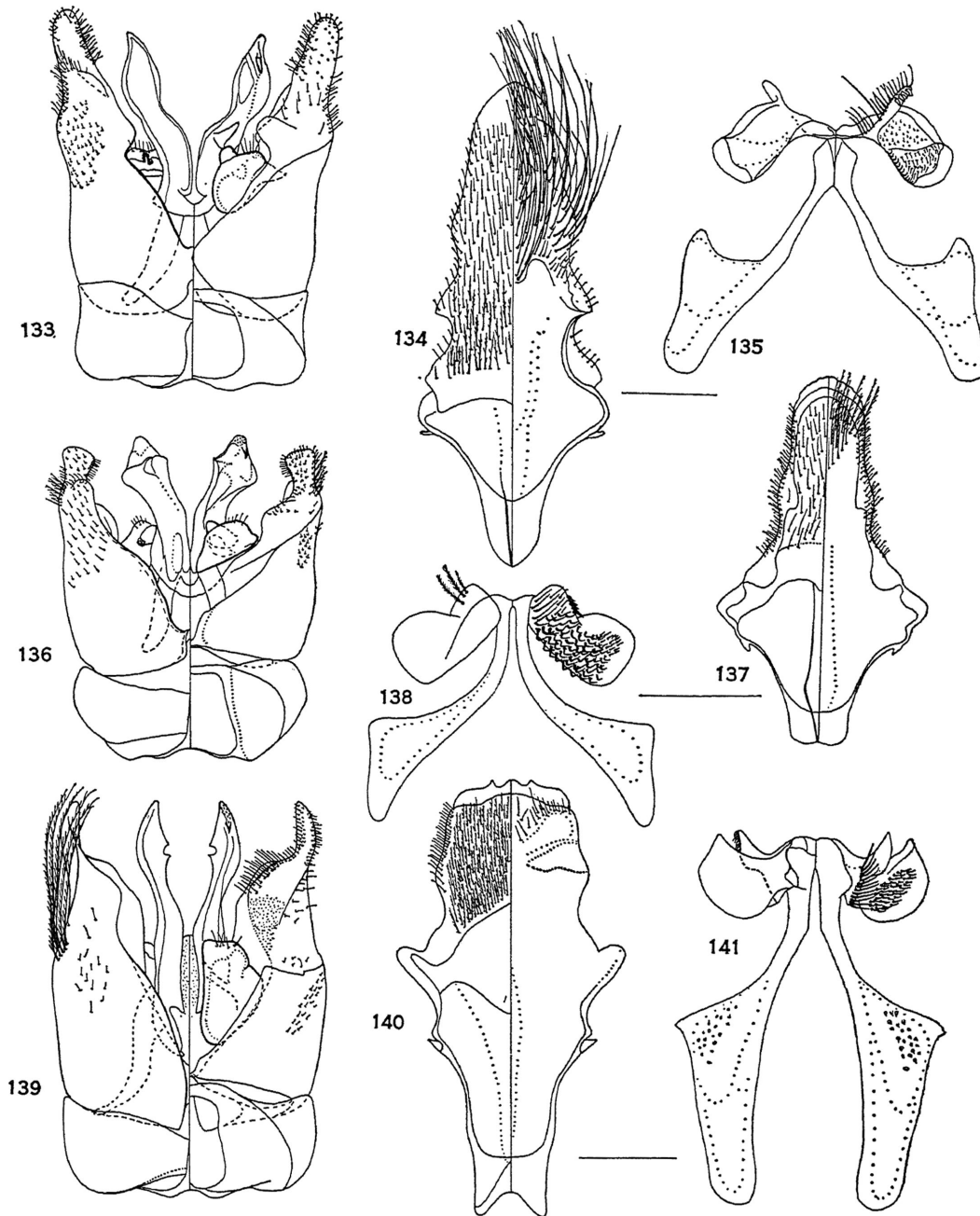
Goniocolletes COCKERELL, 1907a, p. 231. Type:

Goniocolletes morsus Cockerell, 1907 (monobasic and original designation).

In the past the name *Goniocolletes* has been used at the generic level for a few species (group *c* below), known only in the males, having remarkable modifications of the metasoma and legs. It is now clear that these represent merely the extreme of a trend of modification exhibited by a series of species. These species virtually bridge the morphological gap from *Leioproctus* proper to *Goniocolletes* in its original sense. It therefore seems that the latter name can, at best, be recognized at the subgeneric level, and it is here used for the entire group, not merely the most extreme members.

Some species are very similar superficially and, in the small stigma, to the *advena* group of *Leioproctus*. For example, *L. (Leioproctus) ruficornis* was at first placed in *Goniocolletes*, with which it agrees in the broad translucent tergal margins. Only when a specimen was dissected did its true affinities become apparent. The species of group *a* in the list of species have the appearance of ordinary *Leioproctus*, *sensu stricto*, with the metasoma red (black in *dolosus*), without broad translucent tergal margins or basal hair bands. Species of group *b* have the metasoma rather slender, black to red, with broad, depressed, translucent, apical tergal margins (absent in *velutinus*) and with basal hair bands on most of the species. The wings are unusually short, very clear, and often only sparsely hairy basally. In some species the outer hind tibial spur is less than half as long as the inner. The legs of the male are occasionally modified in the direction of group *c*, and the eighth metasomal sternum is somewhat enlarged but not so much so as in group *c*.

In species of group *c* the metasoma is rather slender, dark to red, the terga with broad translucent apical margins, without basal hair bands (at least in the male). As in group *b*, the wings are unusually short and very clear, and they have large hairless areas basally. The legs of the male are modified, the midfemur excavated on the under side with a basal cluster of fused setae projecting into the excavation, the hind tibia arcuate, the outer hind tibial spur small or absent, and the hind basitarsus with a large tooth. The apical process of the eighth metasomal sternum is enormous, the exposed part resembling



FIGS. 133-141. Male genitalia and eighth and seventh sterna of Colletinae. 133-135. *Leioproctus* (*Goniocolletes*) *morsus*. 136-138. *L. (G.) fimbriatus*. 139-141. *L. (G.) dolosus*. Scale lines all represent 0.5 mm.

a produced pygidial plate. Unfortunately females of group *c* are unknown or unrecognized; their discovery might justify its subgeneric separation from groups *a* and *b* in spite of the obvious relationships.

Leioproctus (*G.*) *microdontus* (of which *albopilosus* Rayment is a synonym, new synonymy) is unusual in having the metanotum transversely elevated medially so that in side view it appears to bear a small tooth.

Facial fovea usually distinct and impressed in females (absent in *eugeniarum*, *micrododontus*, and others), weak in males (absent in *aurescens*, *velutinus*, *morsus*, *pallidus*, distinct in *dolosus* and others); scape reaching median ocellus or nearly so; three submarginal cells; stigma parallel sided, small, usually about half as long as part of marginal cell on wing margin; jugal lobe attaining or surpassing cu-v; metanotum in almost all cases not tuberculate; propodeum in profile with a subhorizontal basal zone usually separated from vertical part by a carina (in *dolosus*, basal zone is vertical but separated from rest of triangle by carina as in most other species); inner hind tibial spur of female pectinate, its outer margin not toothed or only weakly so; metasoma weakly punctured (strongly so in *dolosus*), with or without apical hair bands, frequently with basal hair bands or zones of pubescence on terga, pygidial plate of male distinctly defined laterally for some distance in front of tergal apex (in most subgenera the plate is represented by an undefined bare area in the male); seventh metasomal sternum of male with body produced apically as slender stalk to extremity of which are attached two lobes which are directed anterolaterally so that their posterior margins do not extend much behind apex of body of sternum.

DISTRIBUTION: Australia, north to central Queensland and Northern Territory.

INCLUDED SPECIES

- Leioproctus* (*Goniocolletes*) (a) *abdominalis* (Smith, 1879) (*Paracolletes*) n. comb. (B.M.)
 (b) *albopilosus* (Rayment, 1930a) (*Paracolletes*) n. comb. (C.S.I.R.O.)
 (b) *argentifrons* (Smith, 1879) (*Lamprocolletes*) n. comb. (B.M.)
 (b) *aurescens* (Cockerell, 1921) (*Paracolletes*) n. comb. (B.M.)
 (b) *aurifrons* (Smith, 1853) (*Lamprocolletes*) n. comb. (B.M.)
 (a) *clarus* (Rayment, 1935) (*Paracolletes*) n. comb. (C.S.I.R.O.)
 (b) *colletellus* (Cockerell, 1905f) (*Paracolletes*) n. comb. (B.M.)
 (c) *curvipes* Friese, 1924 (*Dasycolletes*) (desc.) n. comb.
 (a) *dolosus* Michener, new species (C.S.I.R.O.)
 (b) *eugeniarum* (Cockerell, 1912c) (*Paracolletes*) n. comb. (B.M.)

- (a) *fimbriatulus* (Cockerell, 1910a) (*Paracolletes*) n. comb. (B.M.)
 (a) *fimbriatus* Smith, 1879 (B.M.)
 (b) *gallipes* (Cockerell, 1913d) (*Paracolletes*) n. comb. (B.M.)
 (a) *hillieri* (Cockerell, 1914f) (*Paracolletes*) n. comb. (B.M.)
 (b) *micrododontus* (Cockerell, 1929d) (*Paracolletes*) n. comb. (Q.M.)
 (c) *morsus* (Cockerell, 1907a) (*Goniocolletes*) n. comb. (A.M.N.H.)
 (c) *pallidus* (Cockerell, 1915b) (*Goniocolletes*) n. comb. (B.M.)
 (b) *perfasciatus* (Cockerell, 1906a) (*Paracolletes*) n. comb. (B.M.)
 (c) *proximus* (Rayment, 1935) (*Goniocolletes*) n. comb. (C.S.I.R.O.)
 (a) *ruficaudus* Michener, new name for *Leioproctus rufiventris* Friese, 1924, Konowia, vol. 3, p. 219, not *Pasiphae rufiventris* Spinola, 1851, transferred to *Leioproctus* with *Bicolletes* ("typus" A.M.N.H.)
 (c) *similior* Michener, new name for *Goniocolletes simillimus* Rayment, 1935, A cluster of bees, p. 686, preoccupied by *Euryglossa simillima* Smith, 1879, now in subgenus *Euryglossidia*, and by *Paracolletes simillimus* Cockerell, 1916c, in *Leioproctus*, *sensu stricto* (C.S.I.R.O.)
 (b) *velutinus* (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)

SUBGENUS EURYGLOSSIDIA COCKERELL

Text figures 145-150

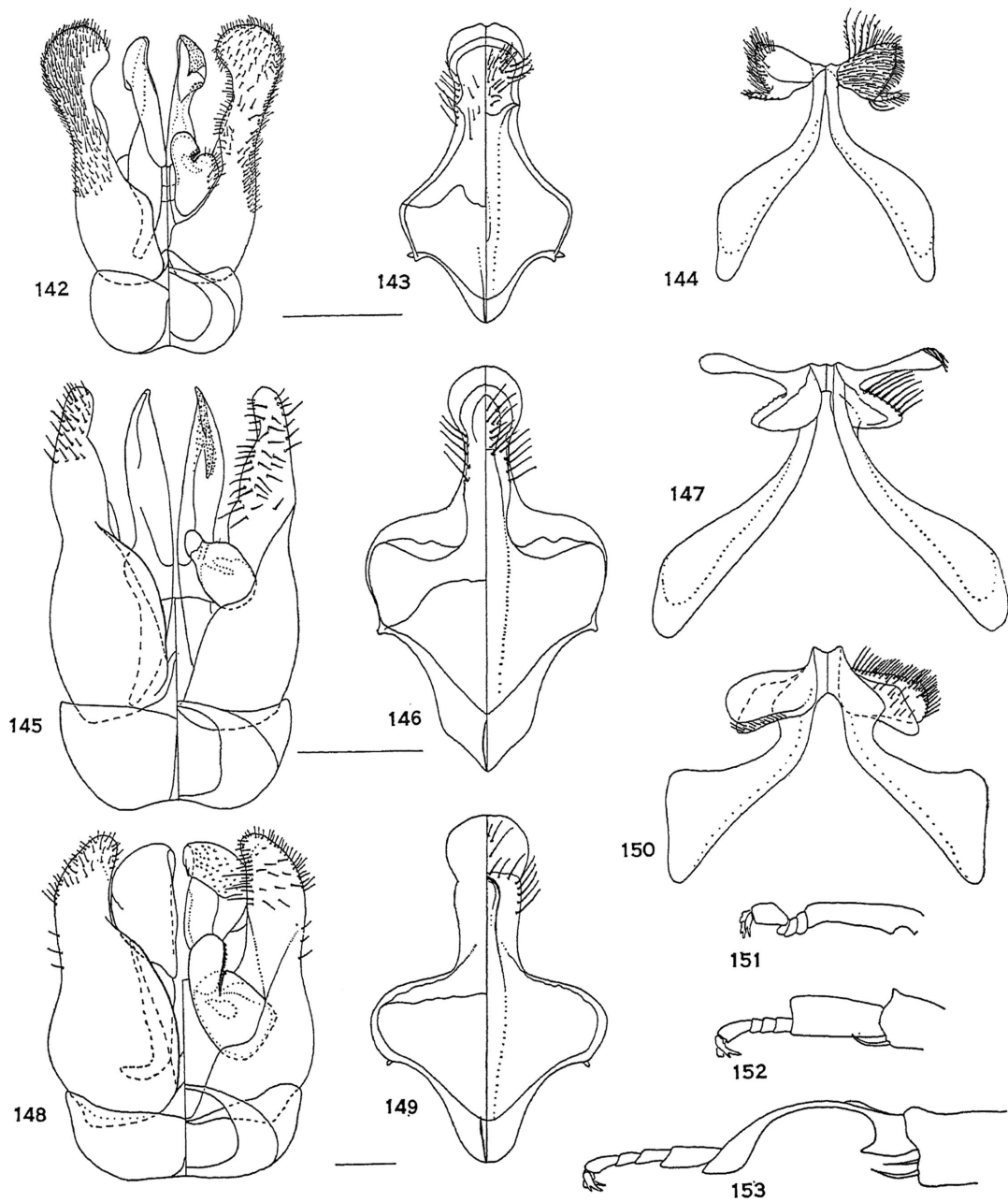
Euryglossidia COCKERELL, 1910e, p. 358. Type: *Euryglossidia rectangulata* Cockerell, 1910 (original designation).

Lysicolletes RAYMENT, 1935, p. 684. Type: *Paracolletes (Lysicolletes) singularis* Rayment, 1935 (original designation).

This subgenus contains a group of small, slender bees having the appearance of slender species of *Leioproctus* proper.

The name of the group is unfortunate as the bees are not related to *Euryglossa*. The name doubtless resulted in Rayment's renaming of the group as *Lysicolletes*; he usually employed *Euryglossidia* for a group of *Euryglossa*.

The coloration is usually feebly metallic green or blue, often with the metasoma partially or wholly red. The integument is typically dully and minutely roughened, a characteristic shared by certain species of *Leioproctus* proper. However, in the latter



FIGS. 142-153. Colletinae. 142-144. Male genitalia and eighth and seventh sterna of *Leio-proctus* (*Goniocolletes*) *argentifrons* (scale line represents 0.5 mm.). 145-147. Same of *L. (Euryglossidia)* *cygnellus* (scale line represents 0.25 mm.). 148-150. Same of *L. (E.) striatulus* (scale line represents 0.125 mm.). 151-153. Fore, middle, and hind tarsi of male of *L. (Notocolletes)* *heterodoxus*.

subgenus coarse punctures are in evidence, while in most species of *Euryglossidia* much of the body (e.g., the scutum) lacks such punctures.

Although most of the species of the subgenus have the inner hind tibial spur of the female conspicuously pectinate, it is ciliate in *striatulus* and *proximus*. Since those forms are nonmetallic and shining punctate rather than dull, I at first considered placing them in a separate subgenus. However, in sternal and genital characters, the short jugal lobe, and the sparse scopa they agree with typical *Euryglossidia*. Moreover, *L. (Leioproctus) abnormis* is similar to *striatulus* and *proximus* but has spurs with slender teeth (the median ones longest instead of the basal ones) so that it is hard to decide whether they are to be called ciliate or pectinate. The same is true of the spur of *halictiformis* which is otherwise an ordinary although very small *Euryglossidia*. Because of the denser scopa of *abnormis* and the longer jugal lobe (nearly reaching the level of cu-v), the somewhat different genitalia, the seventh sternum with the lobes of each side broadly connected so that there are really only two instead of four lobes, and because about half of the specimens seen have three instead of two submarginal cells, *abnormis* has been retained in *Leioproctus* proper. However, as suggested not only by the characters listed above but by its small size and the long antennae in the male, it is seemingly really related to *Euryglossidia* and could almost equally well have been placed in that subgenus.

Leioproctus (E.) cygnellus is unusual in the coarse, close, thoracic punctation, but its appearance and structure are those of *Euryglossidia*, not *Euryglossa* in which it was described.

The name *rubiginosus* is placed here only tentatively. The thoracic dorsum is shiny and greenish, but in other visible characters the species seems like other *Euryglossidia*. The metasoma of the type is gone and has been replaced by a *Euryglossa* metasoma. The inner tibial spur has about five long, slender teeth which are like those on the outer spur but on a larger scale.

The type of *rejectus* also lacks the metasoma and is placed with some hesitation. The scutum is shining with coarse punctures.

Peculiar features of certain *Euryglossidia*, indicating evolutionary trends unique or unusual in the genus, are as follows: apex of marginal cell scarcely separated from the costa in *rectangulatus*, *ichneumonoides*, *mastersi*, and *eraduensis*; claws of female simple in *simillimus* and *singularis*, with only a small blunt, basal tooth in *mastersi*, a large, blunt, basal tooth in *purpurascens*, a small but sharp median tooth in *cyanescens*, somewhat larger tooth in *viridescens* and *nigrescens*, a small subapical tooth in *halictiformis*, and an ordinary tooth, producing a cleft claw, in *eraduensis*, *proximus*, and *striatulus*; scopa on trochanter and femur virtually absent, on tibia consisting of simple hairs in *cyanescens*; in most species the scopa is sparser than usual in *Leioproctus*. The first recurrent vein is far beyond the first transverse cubital.

Facial fovea absent; *scape usually extending beyond median ocellus* (not reaching median ocellus in *nigrescens* and only reaching median ocellus in some others); middle flagellar segments 1.5 to 2.0 times as long as broad; *two submarginal cells*; stigma large, not parallel sided, much more than half of length of costal part of marginal cell; *jugal lobe not reaching cu-v, often quite short*; metanotum not tuberculate; propodeum with long horizontal surface, curving onto subvertical surface without sharp differentiation; *inner hind tibial spur of female pectinate*, rarely ciliate or intermediate; claws variable (see above); metasoma without hair bands, weakly punctured; seventh sternum of male with four apical lobes, in some cases rather broadly connected basally.

DISTRIBUTION: Australia north to southern Queensland. Not abundant in humid eastern coastal region.

INCLUDED SPECIES

- Leioproctus (Euryglossidia) acaciae* (Rayment, 1939) (*Euryglossidia*) n. comb. (C.S.I.R.O.)
australiensis (Dalla Torre, 1896) (*Macropis*) = *Scapter bicolor* Smith, 1862a (B.M.)
baeckiae (Rayment, 1948b) (*Euryglossa*) n. comb. (C.S.I.R.O.)
cyanescens (Cockerell, 1929c) (*Euryglossidia*) n. comb. (A.M.)
cygnellus (Cockerell, 1905e) (*Euryglossa*) n. comb. (B.M.)
eraduensis (Cockerell, 1929c) (*Euryglossidia*) n. comb. (A.M.)

- halictiformis* (Smith, 1879) (*Euryglossa*) n. comb. (B.M.)
ichneumonoides (Cockerell, 1906e) (*Euryglossidia*) n. comb. (B.M.)
imitator (Rayment, 1959a) (*Lysicolletes*) n. comb. (desc.)
mastersi (Cockerell, 1929c) (*Euryglossidia*) n. comb. (A.M.)
nigrescens (Cockerell, 1929c) (*Euryglossidia*) n. comb. (A.M.)
proximus (Rayment, 1959a) (*Filiglossa*) n. comb. (C.S.I.R.O.). This is a homonym of *Goniocolletes proximus* Rayment (1935) but is not renamed because it is a synonym of *striatulus*
purpurascens (Cockerell, 1914j) (*Euryglossidia*) n. comb. (B.M.)
rectangulatus (Cockerell, 1910e) (*Euryglossidia*) n. comb. (B.M.)
rejectus (Cockerell, 1905e) (*Euryglossa*) n. comb. (B.M.)
rubiginosus (Dalla Torre, 1896) (*Euryglossa*) = *Euryglossa rubricata* Smith, 1879, p. 14, n. comb. (B.M.)
simillimus (Smith, 1879) (*Euryglossa*) (B.M.)
singularis (Rayment, 1935) (*Lysicolletes*) n. comb. (C.S.I.R.O.)
striatulus (Rayment, 1959a) (*Filiglossa*) n. comb. (C.S.I.R.O.)
viridescens (Cockerell, 1929c) (*Euryglossidia*) n. comb. (A.M.)
vitrifrons (Smith, 1879) (*Dasycolletes*) n. comb. (B.M.)

Several of the above species are here transferred from *Euryglossa* for the first time; on the other hand, the species described as *Euryglossidia punctata* and *murrayensis* are transferred to *Euryglossa*.

SUBGENUS FILIGLOSSA RAYMENT

Text figure 29

Filiglossa RAYMENT, 1959a, p. 324. Type: *Filiglossa filamentosa* Rayment, 1959 (original designation).

The status of this subgenus remains in doubt. If Rayment (1959a) is correct is describing and illustrating exceedingly long hairs on the maxillary galeae and very long, filamentous labial palpi, the species *filamentosus* is clearly extraordinary and probably warrants placement in a separate subgenus or genus. These features are not shared by the females placed in *Filiglossa* by Rayment. These females (*F. striatula* Rayment = *prox-*

ima Rayment, new synonymy) are members of the subgenus *Euryglossidia*; the male of *striatulus* is now known (Commonwealth Scientific and Industrial Research Organization collection) and is a *Euryglossidia* with no unusual features of the mouthparts.

Unfortunately the unique type male of *filamentosus* is in such condition that the important characters enumerated by Rayment cannot be re-examined. The whole specimen was embedded in glue. When this was dissolved, it was found that Rayment's dissection had had catastrophic results, the head having been broken to remove the mouthparts, and the end of the metasoma having been broken off to remove the genitalia. As with other materials that he removed from specimens, these parts were apparently not preserved. Only Rayment's sketches and descriptions remain to support placement of this species in a distinct group. The genitalia appear to have been similar to those of *Euryglossidia*. The apex of the seventh sternum was broken off even at the time that Rayment's work was done, as indicated in his publication, but could well have been as in *Euryglossidia*. Aside from the mouthparts the only features that indicate that *filamentosus* should be placed in a group separate from *Euryglossidia* are the distinct, coarse thoracic punctures (shared by *striatulus* and certain other *Euryglossidia*) and the position of the first recurrent vein interstitial to the first transverse cubital or essentially so.

The following description is based on the unique male type of *filamentosus* only; characters of the mouthparts are drawn from Rayment (1959a):

Facial fovea absent; maxillary galea with fringe of very long hairs, much longer than whole maxilla; labial palpus much elongated, filamentose, number of segments unknown; two submarginal cells, first recurrent vein interstitial with first transverse cubital or nearly so; stigma large, not parallel sided, nearly as long as costal part of marginal cell; jugal lobe not reaching cu-v, about half as long as vannal lobe; metanotum not tuberculate; propodeum with long horizontal surface, curving onto subvertical surface without sharp differentiation; metasoma without hair bands, only weakly punctured.

DISTRIBUTION: New South Wales.

INCLUDED SPECIES

Leioproctus (*Filiglossa*) *filamentosus* (Rayment, 1959a) n. comb. (C.S.I.R.O.)

SUBGENUS NOTOCOLLETES COCKERELL

Text figures 151-153

Notocolletes COCKERELL, 1916c, p. 44. Type: *Notocolletes heterodoxus* Cockerell, 1916 (monobasic).

This subgenus (known from only one male specimen) resembles a very large, hairy, greenish black *Euryglossidia*, having the same dull, minutely roughened integument. The antennae are even longer (middle flagellar segments three times as long as broad) than those of *Euryglossidia*, the legs are very modified, and the fifth and sixth metasomal sterna are strongly swollen medially.

Facial fovea absent from male (female unknown); scape scarcely reaching anterior ocellus; two submarginal cells, first recurrent more than one-third of length of second cell from base, second recurrent interstitial with last transverse cubitus; stigma large, not parallel sided, two-thirds of length of costal part of marginal cell; jugal lobe not reaching cu-v, less than half as long as vannal; metanotum not tuberculate; propodeum seen in profile with subhorizontal basal part of triangle about as long as vertical part, no carina or sharp dividing line between these parts; metasoma without hair bands, finely roughened and dull.

The more distinctive features of the legs are shown in the accompanying illustrations.

DISTRIBUTION: South Australia.

INCLUDED SPECIES

Leioproctus (*Notocolletes*) *heterodoxus* (Cockerell, 1916c) (*Notocolletes*) n. comb. (B.M.)

BAECOLLETES, NEW SUBGENUS

Plate 3, figures 3-5; text figures 46, 57

TYPE: *Leioproctus calcaratus*, new species.

This subgenus, known from but three small, nonmetallic species with the metasoma red or partly red, is more robust than *Euryglossidia*, having much the form of *Andrenopsis*. The short scape and the form of the facial foveae suggest *Microcolletes*. The tibial spurs are unique in the group. The flat and polished face of two of the species is reminiscent of *Cladocerapis*, but there is clearly no close

affinity with that subgenus. The position of the first recurrent vein is unique in the group.

Facial fovea distinct in female, with sparse punctures; clypeus and supraclypeal area largely impunctate, very flat, except in *minor*; *scape not reaching median ocellus*; *two submarginal cells, first recurrent basal to first transverse cubital*; stigma of moderate size, not parallel sided, much more than half of length of costal part of marginal cell; jugal lobe not reaching to slightly exceeding cu-v; metanotum not tuberculate; propodeum with distinct, roughened, subhorizontal basal zone, shorter than metanotum (nearly as long in *minor*), not separated from vertical part by carina or sharp differentiation; hind tibial spurs of both sexes robust, apices curved, inner one in female with about six stout but rather short teeth of subequal length, *outer one in female with about eight shorter teeth*, teeth in male more numerous but stout; *claws simple* in female; metasoma without hair bands, its punctation weak (or rather coarse in male).

DISTRIBUTION: Western Australia, New South Wales

INCLUDED SPECIES

Leioproctus (*Baeocolletes*) *calcaratus* Michener, new species (W.A.M.)
mas Michener, new species (C.S.I.R.O.)
minus Michener, new species (M.C.Z.)

COLLETELLUS, NEW SUBGENUS

TYPE: *Andrenopsis velutinus* Cockerell, 1929 (= *Leioproctus velutinellus* Michener, new name).

This subgenus is known only in the female, which is unusual among forms with two submarginal cells in having the hind tibial spur ciliate rather than pectinate.

Facial fovea absent; scape short, not approaching level of anterior ocellus, antenna as a whole short, median segments of flagellum much broader than long; *two submarginal cells*; stigma large, not parallel sided, clearly more than half of length of costal edge of marginal cell; jugal lobe exceeding cu-v; metanotum not tuberculate; propodeum in profile with long subhorizontal surface, curving onto vertical surface without sharp differentiation; *inner hind tibial spur ciliate*; claws cleft; metasoma without distinct hair bands, faint apical ones laterally, with orange-

brown integumental bands on basal segments, surface finely punctured.

Additional features of the type species are: basitibial plate clearly more than one-third as long as tibia; eyes converging below; clypeus not protuberant as in *Andrenopsis*; scopa plumose; strigilis about as in *Andrenopsis*.

DISTRIBUTION: Western Australia.

INCLUDED SPECIES

Leioproctus (*Colletellus*) *velutinellus* Michener, new name for *Andrenopsis velutinus* Cockerell, 1929c, Rec. Australian Mus., vol. 17, p. 212, preoccupied in *Leioproctus* by Cockerell, *ibid.*, vol. 17, p. 208) (A.M.)

SUBGENUS ANDRENOPSIS COCKERELL

Plate 3, figures 6, 7; text figures 45, 47, 154–156

Andrenopsis COCKERELL, 1905a, p. 363. Type: *Andrenopsis flavorufus* Cockerell, 1905 (monobasic).

This subgenus contains moderate-sized to small, rather robust, nonmetallic species.

Facial fovea of female broad, distinct because of sparser punctation than adjacent areas and dull surface but only slightly depressed; scape reaching median ocellus; *two submarginal cells*; stigma rather small and parallel sided, half of length of costal part of marginal cell or slightly more; jugal lobe nearly reaching to slightly exceeding cu-v; metanotum not tuberculate but broadly elevated to level of scutellum medially; propodeum in profile essentially vertical, only a short basal zone, half as long as length of metanotum, more or less horizontal; *inner*

hind tibial spur finely pectinate in female; claws of female with inner tooth present but reduced (female known only in *douglasiellus*); metasoma without hair bands, in some cases with orange-brown integumental bands, finely and *densely punctured*, as is rest of body.

The inner hind tibial spur of the male is enlarged and curved in *flavorufus* but not in *wilsoni* or *nigrifrons*. The clypeus of males is yellow except in *nigrifrons* and protuberant in front of the eyes to the extent of nearly half of an eye width, seen from the side. In *douglasiellus* and perhaps *nigrifrons* there are a few very short hairs on the eyes.

DISTRIBUTION: Western Australia to Victoria and southern Queensland.

INCLUDED SPECIES

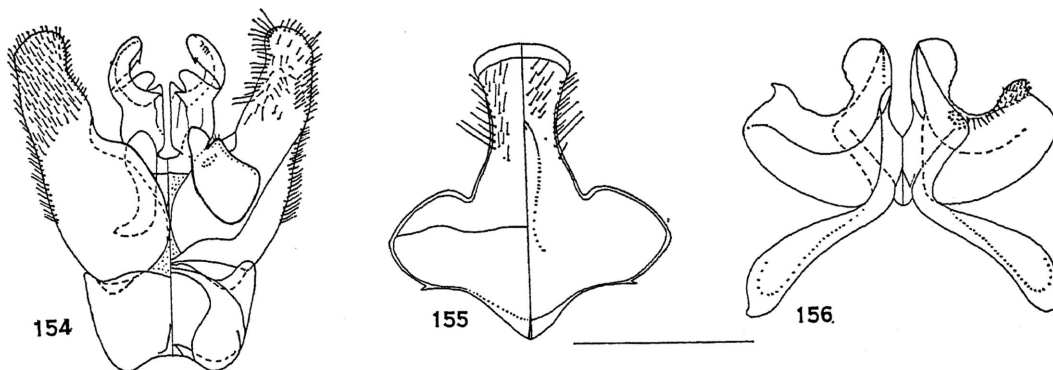
Leioproctus (*Andrenopsis*) *douglasiellus* Michener, new species (W.A.M.)
flavorufus (Cockerell, 1905a) (*Andrenopsis*) n. comb. (B.M.)
nigrifrons Michener, new species (Q.M.)
wilsoni (Rayment, 1930b) (*Andrenopsis*) n. comb. (Wilson)

CHRYSOCOLLETES, NEW SUBGENUS

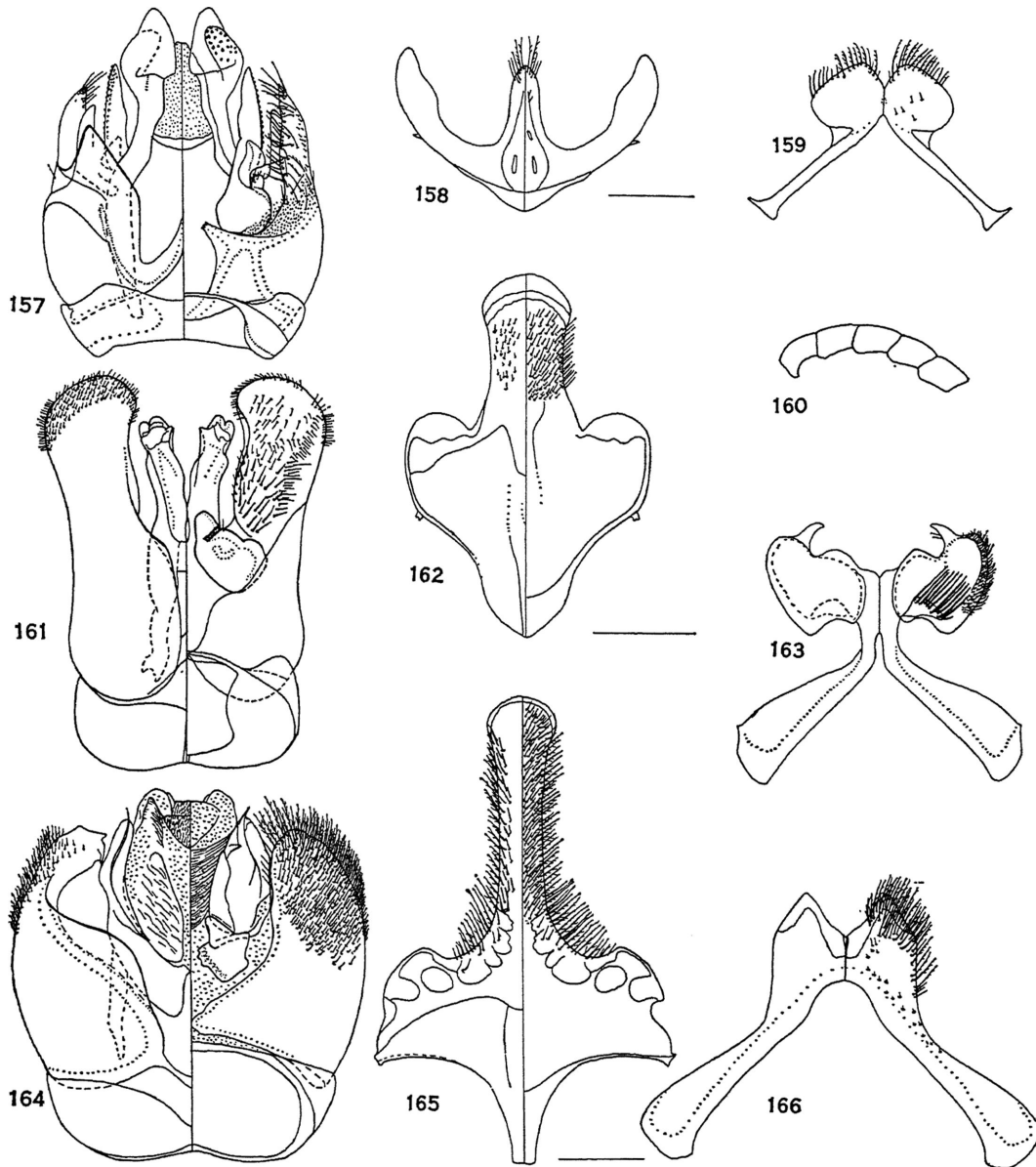
Plate 3, figures 8–10; text figures 31, 58, 157–163

TYPE: *Paracolletes moretonianus* Cockerell, 1905.

This subgenus suggests *Phenacolletes* in the occipital development, so that the median ocellus is about midway between the antennal bases and the posterior edge of the vertex. The appressed, short pubescence of the metasoma in *moretonianus* also suggests *Phenacolletes*, but the rest of the body and the legs



FIGS. 154–156. Colletinae. Male genitalia and eighth and seventh sterna of *Leioproctus* (*Andrenopsis*) *nigrifrons*. Scale line represents 0.5 mm.



FIGS. 157-166. Colletinae. 157-159. Male genitalia and eighth and seventh sterna of *Leioproctus* (*Chrysocolletes*) *moretonianus*. 160. Apex of antenna of male of same, base to the right. 161-163. Male genitalia and eighth and seventh sterna of male of *L.* (*Chrysocolletes*?) *crenulatus*. 164-166. Same parts of *L.* (*Phenacolletes*) *mimus*. Scale lines relate to genitalia and sterna; all represent 0.5 mm.

have ordinary plumose hairs as in other species of *Leioproctus*. The marginal cell is bent away from the costa for a longer distance than in most other *Leioproctus*. The seventh and eighth sterna and the enormous volsellae are also distinctive of *moretonianus*. The

male of *moretonianus* is unique in having the inner prongs of the hind claws much nearer the bases of the claws than on the other legs.

Leioproctus crenulatus is described in order to make known a form midway between *Chrysocolletes* and *Leioproctus* proper. Pre-

sumably from such a form arose the more extreme *moretonianus*.

Facial fovea absent; scape reaching median ocellus; head produced well behind eyes (see key to subgenera); flagellum of male short, all segments, except in some cases second, longer than broad, one side strongly crenulate; three submarginal cells; stigma subparallel sided, less than half as long as costal side of marginal cell, this cell gradually but strongly bent away from wing margin apically and in *moretonianus* strongly appendiculate; jugal lobe nearly two-thirds as long as vannal lobe, reaching or nearly reaching level of vein cu-v; metanotum not tuberculate; propodeum vertical seen in profile; inner hind tibial spur of female finely pectinate, that of male ciliate; metasoma without hair bands, pubescence in *moretonianus* golden. The following characters apply only to *moretonianus*: seventh metasomal sternum with two flat apical lobes broadly attached to body of sternum; eighth with median apical process reduced and translucent, but lateral portions of sternum enormously developed and curved posteriorly, reaching farther back than apex of median projection; volsellae huge, long, heavy, produced posteriorly; gonostyli distinct. In *crenulatus* the genitalia and hidden sterna are like those of *Leioproctus*, *sensu stricto*.

DISTRIBUTION: Southern Queensland, New South Wales.

INCLUDED SPECIES

Leioproctus (*Chrysocolletes*) *crenulatus* Michener, new species (C.S.I.R.O.)
moretonianus (Cockerell, 1905f) (*Paracolletes*) n. comb. (B.M.)

SUBGENUS PHENACOLLETES COCKERELL

Plate 3, figure 11; text figures 36, 164-166

Phenacolletes COCKERELL, 1905d, p. 301. Type: *Phenacolletes mimus* Cockerell, 1905 (monobasic).

This subgenus, known only in the male, is so distinctive in its short pubescence, that of the thoracic dorsum, metasoma, and legs extremely so and appressed, producing a wasplike aspect, that it may well represent a valid genus. Discovery of the female should settle this question. The ocelli are about midway between the antennal bases and the posterior edge of the vertex, as in *Chrysocol-*

letes and a few *Leioproctus* proper. The position of the first recurrent vein, almost at the base of the second submarginal cell, is unique in the genus. The first submarginal cell is longer than the second and third taken together. The complete absence of the apical lobes from the seventh metasomal sternum is also unique.

Cockerell's description is incorrect in emphasizing the near absence of plumose hairs. The hairs of the head, sides and venter of the thorax, and anterior femora, while short, are erect and of the ordinary plumose type found in related bees.

Facial fovea absent (only male known); scape reaching beyond median ocellus; head produced well behind ocelli (see key); antenna short, suggesting that of a female, first and last flagellar segments much longer than broad but others slightly broader than long; three submarginal cells; stigma little more than half as long as costal part of marginal cell, this cell strongly and gradually bent away from costa and strongly appendiculate apically; jugal lobe two-thirds as long as vannal or slightly less, reaching just beyond vein cu-v; metanotum not tuberculate; propodeum vertical seen in profile; metasoma without hair bands, pubescence short and appressed; body finely and closely punctuate; seventh sternum of male with apex bidentate, completely lacking the usual pair of lobes; eighth of the usual form with a heavily sclerotized median apical process; genitalia very short and bulbous, without separate gonostyli.

DISTRIBUTION: Western Australia. A new locality for *mimus* is 10 miles south of Geraldton, November 3, 1958 (E. F. Riek), in the collection of the Commonwealth Scientific and Industrial Research Organization.

INCLUDED SPECIES

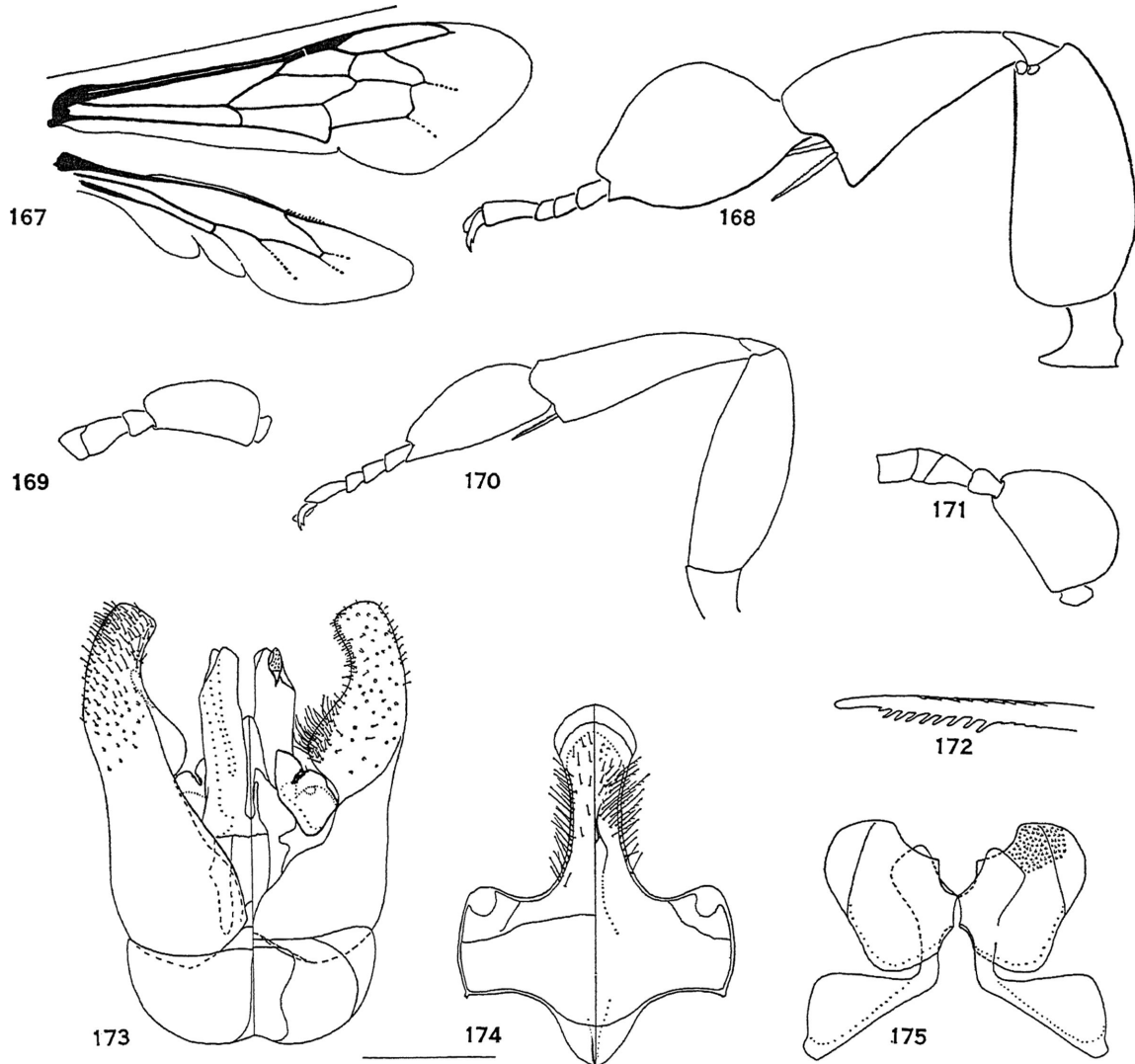
Leioproctus (*Phenacolletes*) *mimus* (Cockerell, 1905d) (*Phenacolletes*) n. comb. (B.M.)

GENUS NEOPASIPHAE PERKINS

Plate 3, figure 12; plate 4, figure 1; text figures 167-175

Neopasiphae PERKINS, 1912, p. 114. Type: *Neopasiphae mirabilis* Perkins (monobasic).

This is the only Australian colletiform bee with a complicated pattern of yellow in-



FIGS. 167-175. Colletinae. 167. Wings of *Neopasiphae mirabilis*. 168. Hind leg of male of same. 169. Base of antenna of male of *N. simplicior*. 170. Hind leg of male of same. 171. Base of antenna of male of *N. mirabilis*. 172. Inner hind tibial spur of female of same. 173-175. Male genitalia and eighth and seventh sterna of same (scale line represents 0.5 mm.).

tegumental markings on the metasoma. The basitibial plate is pointed, in the female less than one-third as long as the tibia, in the male about one-sixth as long as the tibia. The inner hind tibial spur of the female is briefly pectinate with nine to 12 teeth shorter in length than the diameter of the spur. An unusual feature is the absence of the gradulus of the second sternum in females; in males it is procurved medially rather than largely transverse as in *Paracolletes*, *Trichocolletes*,

and *Leioproctus*. Another unusual character is the position of the basal vein, basal to m-cu. The jugal lobe of the hind wing is about three-fourths as long as the vannal and reaches cu-v; the antennae in both sexes are slightly below the middle of the face; the facial foveae are absent. The lateral foveae of the second tergum are unrecognizable or faint broad areas, as in our other colletiform bees.

DISTRIBUTION: Western Australia; one

doubtful record from Victoria (Rayment, 1930b).

INCLUDED SPECIES

Neopasiphae insignis Rayment, 1930b (desc.)
mirabilis Perkins, 1912 (B.M.)
simplicior Michener, new species (W.A.M.)

Females from Western Australia associated with males of *mirabilis* agree with Rayment's description of *insignis*, which is therefore probably a synonym.

HESPEROCOLLETES, NEW GENUS

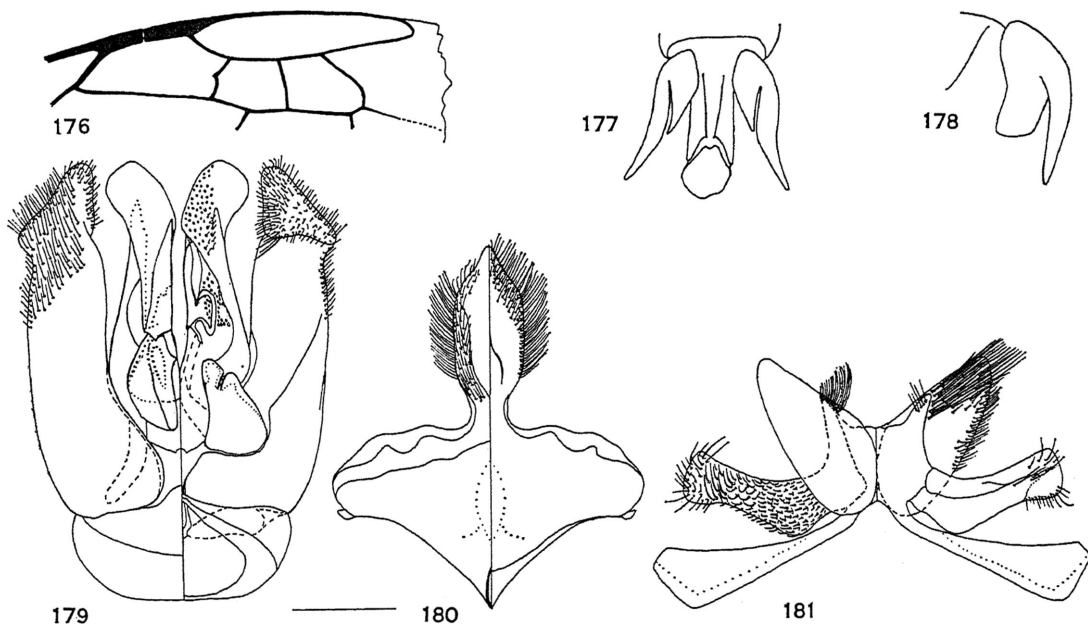
Plate 4, figure 2; text figures 176-181

TYPE: *Hesperocolletes douglasi*, new species.

This genus contains a moderate-sized, non-metallic, black species related to *Trichocolletes* and *Paracolletes* as well as to *Leioproctus*. The stigma is like that in those groups of *Leioproctus* with a slender stigma, such as *Goniocolletes*. The wholly vertical propodeum, as seen in profile, is almost matched in a few groups of *Leioproctus*, but the lack of a defined basitibial plate separates *Hesperocolletes* from most *Leioproctus*. The rather protuberant and yellowish clypeus of the male suggests that of *Paracolletes* and *Trichocolletes*. The most distinctive generic characters (of male

only; female unknown) are (1) the strong carina around, and especially behind, each eye; (2) the near absence of the pre-episternal groove below the scrobal groove; and (3) the deeply cleft claws with the inner prongs broad, flat, and directed more or less ventrally. The short pre-episternal groove suggests the *Stenotritinae*.

Body rather robust (about the form of *Paracolletes crassipes*); facial fovea probably indicated by ill-defined, broad, concave, smooth area; apex of scape reaching median ocellus which is as close to antennal bases as to posterior edge of vertex, but head not especially produced behind eyes and ocelli, antennal bases well above middle of face, separated from clypeus by more than twice diameter of antennal socket; clypeus yellowish, scarcely convex in profile, rather strongly protuberant; flagellum with median segments twice as long as broad; eye surrounded by strong carina except at lower end (weak at upper end); pre-episternal groove below scrobal groove a mere broad, shallow concavity sloping anteroventrally toward anterior surface of mesepisternum; metanotum not produced, strongly convex in profile, sloping steeply, on posterior surface of thorax, its anterior



FIGS. 176-181. Colletinae. *Hesperocolletes douglasi*, male. 176. Portion of forewing. 177. Dorsoapical view of claws and arolium. 178. Side view of claw. 179-181. Male genitalia and eighth and seventh sterna (scale line represents 0.5 mm.).

edge the uppermost point; propodeum nearly vertical in profile, triangle entirely without pitted zone and without basal less vertical zone; stigma slender, nearly parallel sided basal to vein r, nearly half as long as costal edge of marginal cell; three submarginal cells, second and third equal in length and together slightly longer than first; apex of marginal cell rounded away from wing margin; jugal lobe of hind wing too tattered to be recognized; basitibial plate (male) absent; claws large, deeply cleft, inner prong flat and produced ventrally, outer prongs robust and divergent apically, structure approaching that of some female Melectinae; pygidial plate undefined, represented by bare, transversely striate area; seventh metasomal sternum with three pairs of broad apical lobes.

DISTRIBUTION: Western Australia.

INCLUDED SPECIES

Hesperocolletes douglasi Michener, new species (W.A.M.)

GENUS PARACOLLETES SMITH

Plate 4, figures 3-6; text figures 182-194

This generic name is here used for a small group of large species which includes the genotypes of both *Paracolletes* and *Anthoglossa*. These bees appear related to one another in spite of the fact that the name *Paracolletes* has usually been used to include the species of *Leioproctus* and the name *Anthoglossa* has been used to include some of the species properly placed in *Trichocolletes*.

The body is nonmetallic, black, or the metasoma is partly (*nigrocinctus*) or wholly (*rubellus*, *callander*) red in the male. The inner hind tibial spur of the female is usually finely serrate, but in *plumata* the teeth are elongated so that it is finely pectinate, and in *cygni* there are fewer and even longer teeth. Such pectinate spurs, however, differ strikingly from those of *Trichocolletes*. The propodeum is declivous, in some cases sloping above, the triangular area without differentiated horizontal and posterior surfaces. The jugal lobe of the hind wing is about two-thirds as long as the vannal lobe and nearly reaches the level of cu-v in the subgenus *Paracolletes* proper. It is nearly as long in *cygni* and *montanus*. In the other species the jugal lobe is little if any more than half as long as the

vannal. In males the clypeus is yellow or partly so in *callander* and *nigrocinctus*, black in *Paracolletes* proper and *frederici*. The male antennae are often quite long, for which reason some species were described in *Tetralonia* (Anthophoridae). In *Paracolletes* proper the first flagellar segment is broader than long; in *frederici* and *nigrocinctus* it is longer than broad but still shorter than the following segments, while in *callander* it is nearly as long as the following segments. The second and third submarginal cells are relatively short (the second about half as long as the first) in *Paracolletes* proper and in *nigrocinctus*; they are longer in *rubellus* and *callander* and still longer in the species originally placed in *Anthoglossa*.

The above discussion gives some idea of the erratic combinations of characters found among the species. It is possible to recognize a homogeneous *crassipes* group (*Paracolletes* proper) and a more diversified assembly of other species tentatively called *Anthoglossa*. When males of more species, and especially of *plumata*, the type of *Anthoglossa*, become known, the situation will be much clearer.

KEY TO THE SUBGENERA OF *Paracolletes*

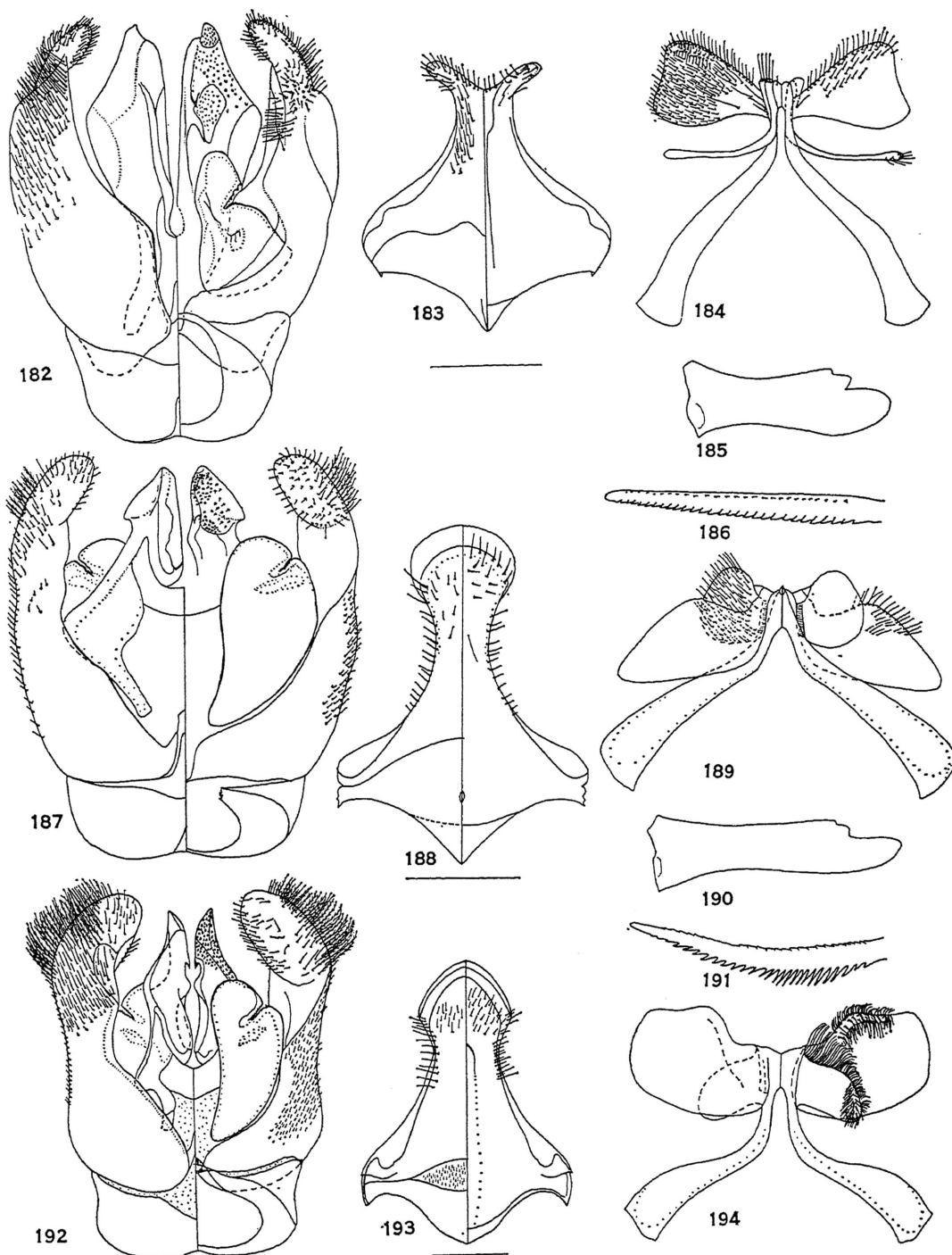
Metasoma with apical tergal hair bands (except in *cygni* and *montanus*); basitibial plate of male completely defined, of female usually exposed, rounded apically (angulate in *montanus*), one-fifth as long as tibia or less (one-fourth in *montanus*), jugal lobe of hind wing little more than half as long as vannal (nearly two-thirds in *cygni* and *montanus*); first flagellar segment of male longer than broad; apical lobes of seventh sternum of male broad *Anthoglossa*
Metasoma without hair bands; basitibial plate of male not or scarcely defined anteriorly, of female hidden by hairs, bluntly rounded apically, nearly one-fourth as long as tibia; jugal lobe of hind wing about two-thirds as long as vannal and nearly reaching level of vein cu-v; first flagellar segment of male broader than long; apical lobes of seventh sternum of male linear *Paracolletes, sensu stricto*

SUBGENUS PARACOLLETES SMITH, SENSU STRICTO

Plate 4, figures 3, 4; text figures 182-186

Paracolletes SMITH, 1853, p. 6. Type: *Paracolletes crassipes* Smith (monobasic).

DISTRIBUTION: Australia, at least north to central Queensland.



FIGS. 182-194. Colletinae. 182-184. Male genitalia and eighth and seventh sterna of *Paracolletes* (*Paracolletes*) *crassipes*. 185, 186. Mandible and inner hind tibial spur of female of same. 187-189. Male genitalia and eighth and seventh sterna of *P. (Anthoglossa) nigrocinctus*. 190, 191. Mandible and inner hind tibial spur of female of *P. (A.) plumatus*. 192-194. Male genitalia and eighth and seventh sterna of *P. (A.) callander*. Scale lines are for male genitalia and sterna; all scale lines represent 0.5 mm.

INCLUDED SPECIES

Paracolletes (*Paracolletes*) *australis* Friese, 1924 (desc.)

brevicornis (Smith, 1854) (*Tetralonia*) (B.M.)

convictus (Cockerell, 1909a) (*Tetralonia*) (B.M.)

crassipes Smith, 1853 (B.M.)

fervidus Smith, 1879 (B.M.)

leptospermi Cockerell, 1912c (B.M.)

rebellis Cockerell, 1912c (B.M.)

subfuscus Cockerell, 1906a (B.M.)

submacrodonatus Rayment, 1934, described again as new, 1935 (C.S.I.R.O.)¹

Paracolletes frederici has much the appearance of a member of this subgenus, although on the basis of the characters here utilized (hidden sterna and genitalia not dissected from the unique type) it falls in *Anthoglossa*.

SUBGENUS ANTHOGLOSSA SMITH

Plate 4, figures 5, 6; text figures 187-194

Anthoglossa SMITH, 1853, p. 16. Type: *Anthoglossa plumata* Smith (monobasic).

DISTRIBUTION: Mostly Western Australia, one species from Victoria.

INCLUDED SPECIES

Paracolletes (*Anthoglossa*) *callander* Cockerell, 1915b (B.M.)

cygni (Cockerell, 1904b) (*Anthoglossa*) n. comb. (B.M.)

frederici (Cockerell, 1905a) = *Lamprocolletes rubellus* Smith, 1868a, not *Dasycolletes rubellus* Smith, 1862a (B.M.)

montanus Rayment, 1935 (C.S.I.R.O.)

nigrocinctus Cockerell, 1914e (B.M.)

plumatus (Smith, 1853) (*Anthoglossa*) n. comb. (B.M.)

robustus Cockerell, 1929c (A.M.)

tenuicinctus Cockerell, 1914f (B.M.)

vittatus (Rayment, 1931b) (*Anthoglossa*) n. comb. (W.A.M.)

GENUS TRICHOCOLLETES COCKERELL

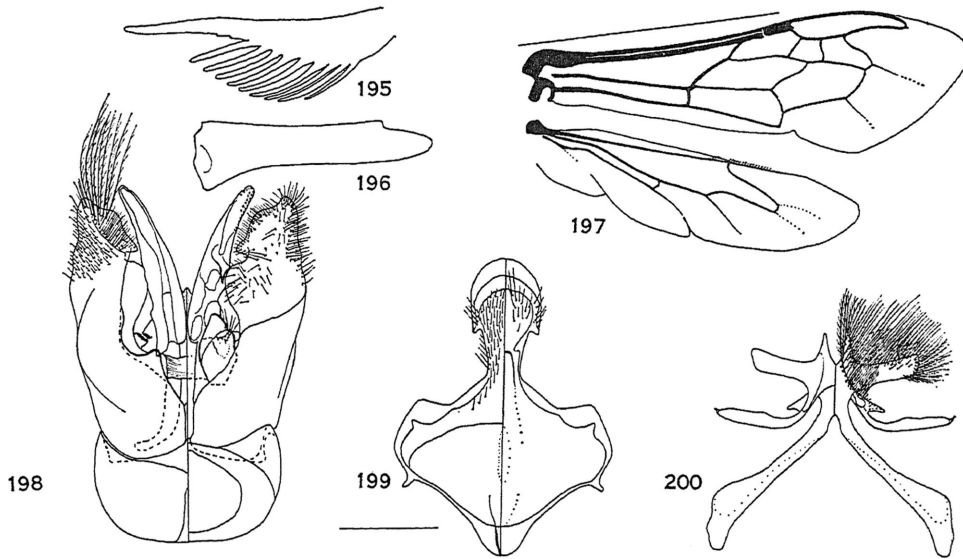
Plate 4, figures 7-12; text figures 195-209

This genus is here used in a much broader sense than previously, to include a considerable number of moderate-sized to large species, most of which have been placed in *Anthoglossa* or *Paracolletes*. Those that I have seen in the field differ from *Paracolletes* and *Leioproctus* in their exceedingly fast flight and frequent hovering. *Paracolletes* and *Leio-*

proctus, by contrast, fly like most species of *Andrena*.

One group of species, *a*, has the metasoma black, with the tergal margins broadly golden to straw colored, translucent. This group includes some of the *Anthoglossa* of earlier authors, *Trichocolletes* in its narrowest sense, and the *Paracolletes marginatus* group of authors. Another group of species (including *Paracolletes erythrurus*, *latifrons*, and others) has the metasoma black or red, with the translucent tergal margins less conspicuous or absent and not golden. The species *pulcherrimus* has the metasoma largely red but with golden tergal margins in the male, and *rufibasis* has the metasoma black and red, with straw-colored marginal bands. Thus the two groups are connected. Species of group *a* often have the inner tooth of the tarsal claw of the female reduced (*aureotinctus*, *sericeus*, *marginatulus*) or absent (*marginatus*, *venustus*, *dives*), but *T. hackeri* has fully cleft claws. Species of group *b* also may have the claws cleft as usual in the *Paracolletini* (*pulcherrima*), or the inner teeth may be somewhat reduced (*latifrons*) or absent (*erythrurus*, *burnsi*). The eyes of both sexes commonly diverge below, but in certain species, such as *venustus*, *hackeri*, *marginatulus*, and *sericeus*, they are approximately parallel. The lower part of the clypeus is commonly strongly protuberant, as in anthophorine bees, but not or little so in *hackeri*, *venustus*, and some others. Most species of group *a* have the second submarginal cell rather large and quadrate. However, in the *marginatus* group the cell is smaller and narrows anteriorly, as is true also in some species of group *b*. Individual variation is considerable, and some individuals of *erythrurus* have the cell fully as large and quadrate as some individuals of group *a*. As the name suggests, species of *Trichocolletes* in the narrowest sense have hairy eyes. However, there seem to be no other important characters separating them from some other species of the genus. In view of the many combinations of the characters mentioned above, clear-cut groups separated by numerous characters are not apparent within this genus. It therefore seems best to divide it only as indicated below in spite of the morphological diversity of extreme species. Noteworthy characters of sin-

¹ Transfer of this species to *Stenotritus* (*Stenotritinae*) by Rayment in 1939 was an error.



FIGS. 195–200. Colletinae, *Trichocolletes* (*Trichocolletes*) *venustus*. 195, 196. Inner hind tibial spur and mandible of female. 197. Wings (scale line represents 5 mm.). 198–200. Male genitalia and eighth and seventh sterna (scale line represents 0.5 mm.).

gle species are the greatly shortened labial palpi (second and third segments much broader than long) of *hackeri* and the swollen hind legs, lacking tibial spurs, in the male of *pulcherrimus*.

In all species of the genus the metasoma has a sericeous texture due to very fine sculpturing and short appressed pubescence. Metasomal hair bands are rarely evident. The propodeal triangle is dull, declivous, the upper part often sloping but not sharply separated from the vertical portion. The broadly pectinate, almost palmate inner hind tibial spur of the female and the pectinate strigilis are distinctive.

Nests of *Trichocolletes* in sandy soil have been recorded by Rayment (1929a, 1935).

KEY TO THE SUBGENERA OF *Trichocolletes*

Hind tibial spurs of male present; basitibial plate of female defined only posteriorly, apex not evident. *Trichocolletes*, *sensu stricto*

Hind tibial spurs of male absent; basitibial plate of female complete except for indefinite apex *Callocolletes*

SUBGENUS **TRICHOCOLLETES** COCKERELL, SENSU STRICTO

Plate 4, figures 7–10; text figures 195–206

Trichocolletes COCKERELL, 1912f, p. 176. Type:

Lamprocolletes venustus Smith, 1862 (monobasic and original designation).

As here interpreted, this subgenus includes all species of the genus except *pulcherrimus*.

Basitibial plate of female defined only posteriorly, apex not evident; that of male variable but when present smaller than that of *Callocolletes*; hind tibial spurs of male present; stigma less than 1.5 times as long as prestigma.

In the accompanying list of species, those marked *a* belong to group *a* of the discussion; *b*, to group *b*. Those marked *a'* have hairy eyes and hence constitute *Trichocolletes* in the sense of previous authors.

INCLUDED SPECIES

- Trichocolletes* (*Trichocolletes*) (a) *aureotinctus* (Cockerell, 1906e) (*Anthoglossa*) n. comb.
 (b) *burnsi* Michener, new species (Burns, N.M.V.)
 (b) *chrysostomus* (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
 (a') *daviesiae* Rayment, 1931b (C.S.I.R.O.)
 (a) *dives* Cockerell, 1914f) (*Anthoglossa*) n. comb. (B.M.)
 (a') *dowerinensis* Rayment, 1931b (C.S.I.R.O.)
 (b) *erythrurus* (Cockerell, 1914e) (*Paracolletes*) n. comb. (B.M.)
 (a) *hackeri* (Cockerell, 1913h) (*Anthoglossa*) n. comb. (Q.M.)

- (b) *latifrons* (Cockerell, 1914f) (*Paracolletes*) n. comb. (B.M.)
- (a) *lucidus* (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
- (a) *marginatulus* Michener, new species (C.S.I.R.O.)
- (a) *marginatus* (Smith, 1879) (*Paracolletes*) n. comb. (B.M.)
- (a') *maximus* (Cockerell, 1929a) (*Paracolletes*) n. comb. (A.M.N.H.)
- (a') *nigroclypeatus* Rayment, 1929a, described as new in 1929b (C.S.I.R.O.)
- (b) *rufibasis* (Cockerell, 1929c) (*Paracolletes*) n. comb. (A.M.)
- (b) *rufopilosus* (Rayment, 1935) (*Paracolletes*) n. comb. (C.S.I.R.O.)
- (b) *rufus* (Rayment, 1930b) (*Paracolletes*) n. comb. (C.S.I.R.O.)
- (a) *sericeus* (Smith, 1862a) (*Anthoglossa*) n. comb. (B.M.)
- (a') *tenuiculus* Rayment, 1931b (C.S.I.R.O.)
- (a') *venustus* (Smith, 1862a) (*Lamprocolletes*) (B.M.)

CALLOCOLLETES, NEW SUBGENUS

Plate 4, figure 11, 12; text figures 207-209

TYPE: *Trichocolletes pulcherrimus*, new species.

Because of the retention of a primitive character unusual in the genus, a more than usually complete basitibial plate, the many peculiar features of *T. pulcherrimus* are thought to suggest a long-independent evolution rather than recent high specialization. The subgenus is characterized as follows:

Basitibial plate of female complete except for the indefinite apex, but little pointed, about one-fourth as long as tibia; basitibial plate of male well defined, about one-fourth as long as tibia; *hind tibial spurs of male absent*; stigma more than 1.5 times as long as prestigma.

Other characters are indicated in the specific description; unless more species are found, no distinction can be made between specific and group characters.

DISTRIBUTION: Western Australia.

INCLUDED SPECIES

Trichocolletes (*Callocolletes*) *pulcherrimus* Michener, new species (W.A.M.)

SUBFAMILY STENOTRITINAE

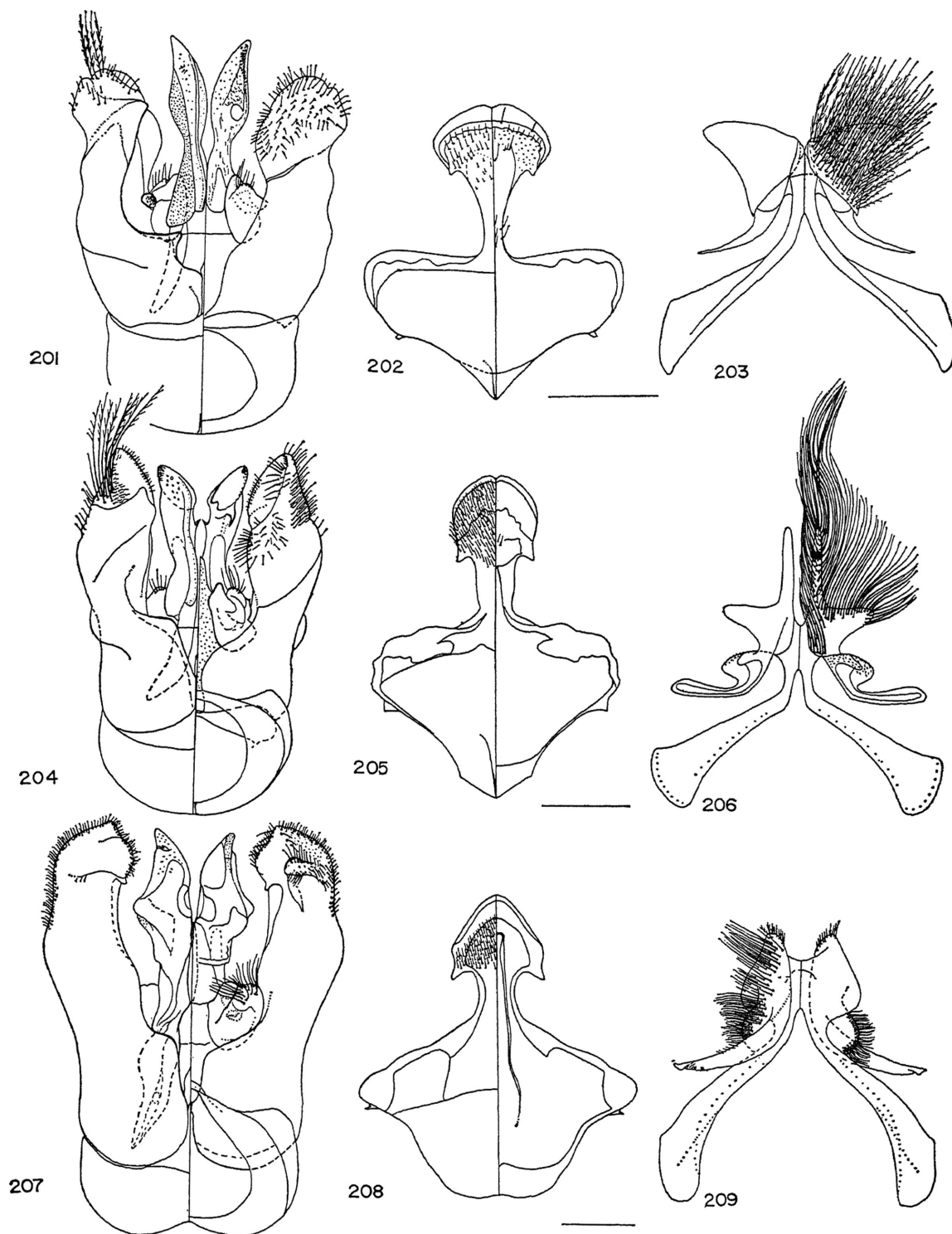
This subfamily consists of moderate-sized

to very large, hairy bees found only in Australia. Among Australian colletids they can be recognized at once by the *long first flagellar segment*, which is longer than the scape, and by the *short, rather blunt, but nonbifid glossa*. The latter is a unique character, not shared by other bees (except males of a few Hylaeinae).

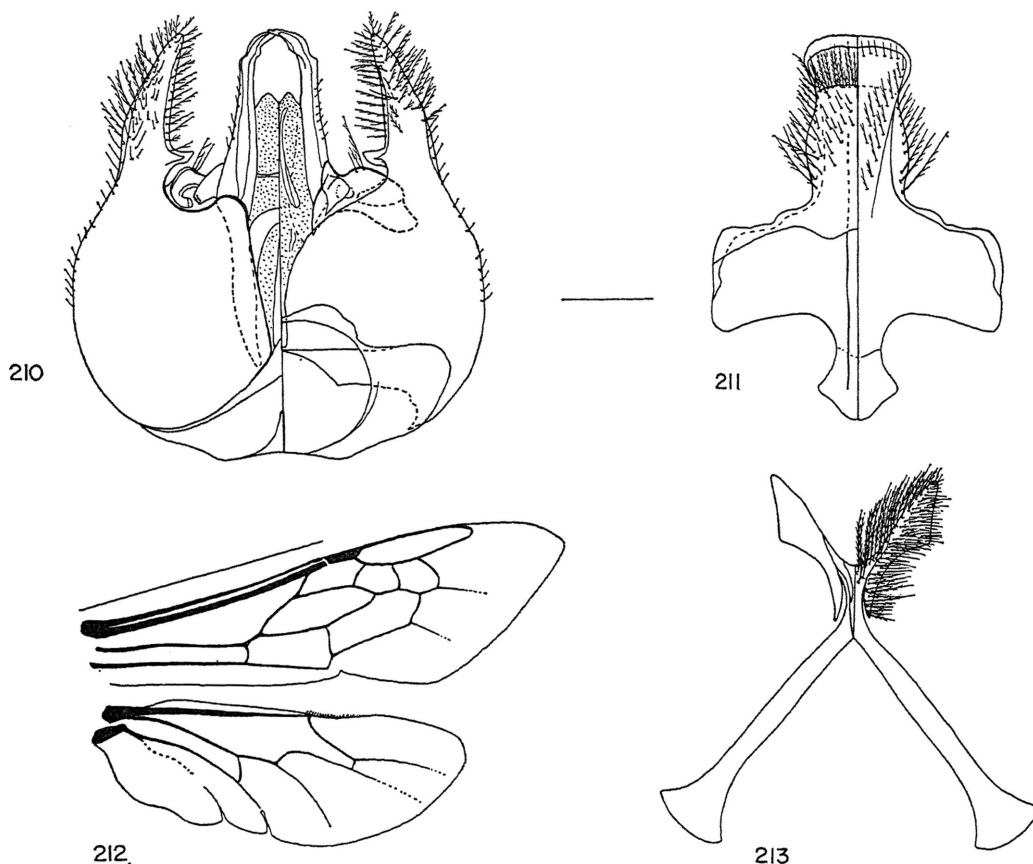
A unique feature is the presence of two subantennal sutures on each side, suggesting the family Andrenidae, but unlike that group the sutures of each side fuse before they meet the epistomal suture. In some species these sutures are scarcely noticeable, but in others (e.g., *Ctenocolletes smaragdinus*) they are very distinct. Another distinctive feature is the location of the ocelli, low on the frons, nearer the antennal bases than the posterior margin of the vertex. The lack of the pre-episternal groove (below the scrobal groove) is another almost unique feature among Australian colletids (see *Hesperocolletes*), although the South American Diphaglossinae exhibit this same feature. The anterior basitarsus of the female has a comb of long hairs along the outer margin and a comb of bristles at least apically (in some cases obscured by hairs) along the inner margin. Similar combs occur in various other large bees. The facial foveae are not or scarcely depressed but are recognizable in the females; they are broad areas, only slightly longer than broad, filling much of the space between the lateral ocelli and the eyes.

I am following custom in including the Stenotritinae in the Colletidae, but there are striking resemblances to the American andrenid groups Oxaeinae and Euerbstiinae. The family classification of bees obviously requires further attention.

Although superficially similar, the two genera are strikingly different in various characters, especially the apical sterna of the males. I know of no bee except *Ctenocolletes* in which the eighth metasomal sternum has a large, exposed, hairy disc. The propodeal character indicated in the generic descriptions is ordinarily the best distinguishing feature but breaks down completely in an undescribed species of *Ctenocolletes* known from one badly preserved specimen in the collection of the Commonwealth Scientific and Industrial Research Organization.



FIGS. 201-209. Male genitalia and eighth and seventh sterna of Colletinae. 201-203. *Trichocolletes* (*Trichocolletes*) *marginatulus*. 204-206. *T. (T.) hackeri*. 207-209. *T. (Callocolletes)* *pulcherrimus*. All scale lines represent 0.5 mm.



FIGS. 210-213. *Stenotritinae*, *Stenotritus pubescens*. 210-212. Male genitalia and eighth and seventh sterna (scale line represents 0.5 mm.). 213. Wings (scale line represents 5 mm.).

KEY TO THE GENERA OF THE STENOTRITINAE

- Male with well-defined pygidial area; seventh and eighth sterna of male with more or less broad discs; inner hind tibial spur of female with four to six coarse teeth (in some cases additional slender ones) *Ctenocolletes*
 Male with bare area not defined by carinae on seventh metasomal tergum; seventh and eighth metasomal sterna as usual in Colletidae; inner hind tibial spur of female with nine to 13 coarse teeth *Stenotritus*

GENUS STENOTRITUS SMITH

Text figures 210-213

Stenotritus SMITH, 1853, p. 119. Type: *Stenotritus elegans* Smith, 1853 (monobasic).

Oestropsis SMITH, 1868a (not Brauer, 1868), p. 253. Type: *Oestropsis pubescens* Smith, 1868 (monobasic).

Gastropsis SMITH, 1868b, p. xxxix. Type: *Oestropsis pubescens* Smith, 1868 (autobasic).

Melitribus RAYMENT, 1930c, p. 217. Type: *Melitribus greavesi* Rayment, 1930.

The species of this genus average smaller than those of *Ctenocolletes*. *Stenotritus elegans*, the largest, reaches 17 mm. in length but the smallest, *ferricornis*, is only 11 mm. long. Most are nonmetallic, but *elegantior* has a weakly bluish metasoma, and *nitidus* is dark metallic blue.

Propodeal triangle relatively large, at least as long as metanotum and occupying half of distance from summit of propodeum to upper margin of propodeal pit or more, lateral margins of propodeal triangle continued as well-separated lines into propodeal pit; *seventh tergum of male with nearly bare area but no defined pygidial plate*; tibial spurs (except inner hind one) and apical spine of strigilis finely pectinate, *inner hind tibial spur with*

nine to 13 coarse teeth; distitarsi, claws, and arolia of male of moderate size, claws not or little longer than second tarsal segment (distinctly longer in *greavesi*); seventh and eighth sterna of the usual colletid style, the seventh V-shaped, with a pair of lobes arising from the angle of the V, the eighth with the disc hairless, hidden, only the median apical process exposed and hairy.

DISTRIBUTION: Australia, north to central Queensland.

INCLUDED SPECIES

- Stenotritus elegans* Smith, 1853 (B.M.)
elegantior Cockerell, 1921 (Q.M.)
ferricornis (Cockerell, 1916) (*Paracolletes*) n. comb. (B.M.)
greavesi (Rayment, 1930c) (*Melitribus*) (C.S.I.R.O.)
nigrescens (Friese, 1924) (*Gastropsis*) (desc.)
nitidus (Smith, 1879) (*Paracolletes*) n. comb. (B.M.)
pubescens (Smith, 1868a) (*Oestropsis*) (B.M.)
rufocollaris (Cockerell, 1921) (*Gastropsis*) (B.M.)
splendidus (Rayment, 1930d) (*Melitribus*) (W. Agric.)
victoriae (Cockerell, 1906e) (*Gastropsis*) (B.M.)

GENUS CTENOCOLLETES COCKERELL

Plate 5, figures 1-4; text figures 214-222

Ctenocolletes COCKERELL, 1929h, p. 358. Type: *Stenotritus nicholsoni* Cockerell, 1929 (monobasic).

Several species of the genus are nonmetallic, with abundant pile. *Ctenocolletes smaragdinus* (including *glauerti* and *speciosus*), however, is entirely brilliant metallic green, the pubescence inconspicuous. It is the most showy bee in Australia. It differs from other members of the genus by the more slender pygidial plate of the male, the more numerous teeth on the apical part of the strigilis, the serrate rather than pectinate distal half of the mesotibial spur, the even smaller propodeal triangle (less than half as long as metanotum in the female, about as long as metanotum in male, as is also true of *ordensis*), and the presence of a long, upcurved, apical horn on the eighth sternum of the male.

Propodeal triangle usually small, usually shorter than metanotum and usually occupying less than half of distance from summit of propodeum to upper margin of propodeal pit; lateral margins of propodeal triangle us-

ually continuing as closely approximated lines (separated by less than least width of first flagellar segment) into propodeal pit; *seventh tergum of male with large, elevated, well-defined pygidial plate*; tibial spurs and apical spine of strigilis of female coarsely pectinate, *inner hind tibial spur of female with four to six coarse teeth* and in some cases two to four slender ones in addition; distitarsi, claws, and arolia of male usually large, claws usually markedly longer than second tarsal segment; *seventh sternum a transverse band* (or in *ordensis* produced posteriorly at each side so that it is emarginate), with hairs along posterior margin and no indication of either the usual colletid apical lobes or the long basal apodemes; *eighth sternum large, the disc exposed and hairy*.

DISTRIBUTION: New South Wales, Western Australia (most abundant in latter state).

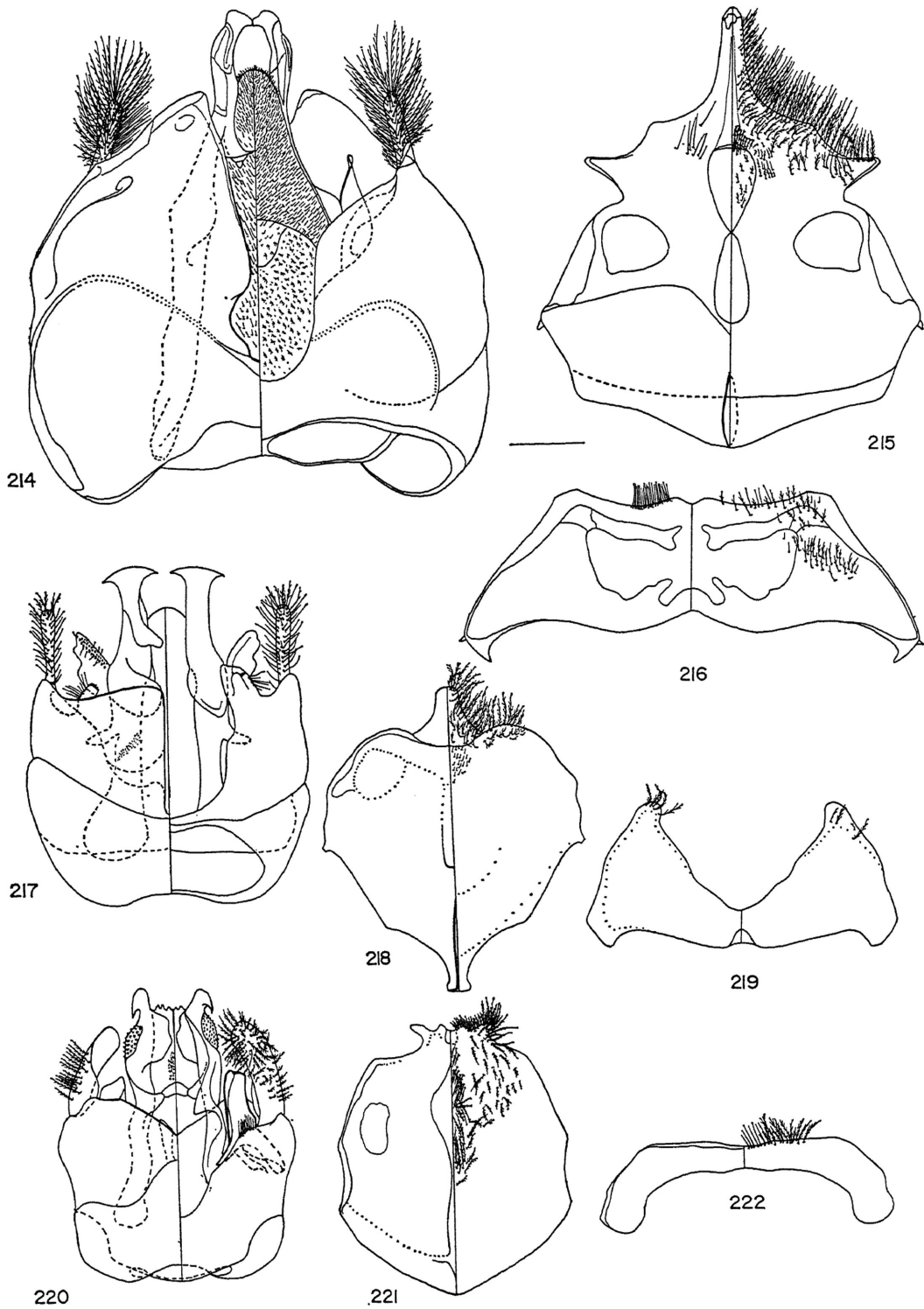
INCLUDED SPECIES

- Ctenocolletes albomarginatus* Michener, new species (C.S.I.R.O.)
glauerti (Rayment, 1930d, redescribed as new 1930e) (*Melitribus*) n. comb. (W.A.M.)
murrayensis Rayment, 1935 (C.S.I.R.O.)
nicholsoni (Cockerell, 1929) (*Stenotritus*) n. comb. (A.M.)
notabilis Michener, new species (C.S.I.R.O.)
ordensis Michener, new species (W.A.M.)
smaragdinus (Smith, 1868a) (*Stenotritus*) n. comb. (B.M.)
speciosus (Rayment, 1935) (*Stenotritus*) n. comb. (C.S.I.R.O.)

SUBFAMILY EURYGLOSSINAE

The bees of this subfamily, which occurs only in Tasmania and Australia, like the Hyalaeinae and Chilicolinae, lack a pollen-collecting scopa in the female. Some of them are quite hairy, however, unlike the Hylaeinae. Nonetheless, pollen is carried to their nests only in the crop and not on the hairs of the body or legs.

Distinctive features of the subfamily include the basitibial plates, which are almost always recognizable, at least in females, and which commonly are delimited, not by a carina as in most bees, but by a series of enormous tubercles which result from subdivision and elevation of the usual carina. The pygidial plate is present in females and has a distinctive, slender, more or less parallel-sided form; such a plate is absent from males.



FIGS. 214-222. Male genitalia and eighth and seventh sterna of Stenotritinae. 214-216. *Ctenocolletes smaragdinus* (scale line represents 0.05 mm.). 217-219. *C. ordensis*. 220-222. *C. notabilis*.

The anterior face of the first metasomal tergum differs from that of most Hylaeinae in having a longitudinal median groove. Also in contrast to most Hylaeinae, the face is usually broad and the clypeus does not extend high above the level of the tentorial pits. The paraglossae are large and basally are broad, often somewhat sclerotized, and usually bristly; the glossa is broad and short, apically shallowly emarginate.

The Euryglossinae can be divided into two groups according to the size of the second submarginal cell. In one group this cell is much less than half as long as the first, and the first recurrent vein enters the apical part of the first submarginal cell or is interstitial. Genera included in this group are: *Pachyprosopis*, *Euryglossina*, *Euryglossula*, and *Brachyhesma*.

In the other group the second submarginal cell is usually nearly half as long as the first to more than half as long as the first, and the first recurrent vein enters the basal part of the second submarginal cell or is interstitial. This group includes all the remaining genera, except that many specimens of *Hypheuma* would fall better in the first group.

I believe that these two groups are natural units; they are supported in general by the first two couplets of the following key, although, as shown by that key, *Brachyhesma* agrees in certain features with the second group instead of the first.

The size of the second submarginal cell and the position of the first recurrent vein are sufficiently variable, even within species but also among them, that these characters are unsatisfactory in keys even though of obvious importance in grouping.

KEY TO THE GENERA OF THE EUROGLOSSINAE

1. First abscissa of vein Rs transverse, angles α and β^1 (at least β) about right-angled; lower end of eye of female protruding mesad above mandibular base (only slightly in *Euryglossula* and subgenus *Microdontura*) so that upper mandibular articulation is usually on a line with median axis of eye; posterior margin of first submarginal cell straight. (Lateral fovea of second tergum well de-

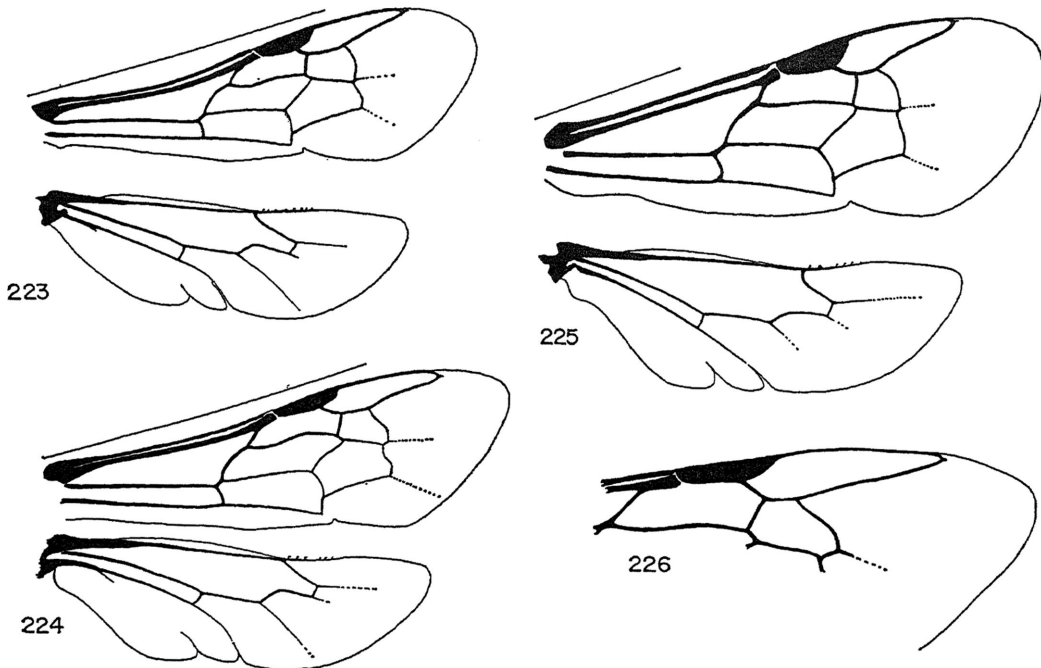
¹ Angle α is the apical angle of cell R, between vein R and the first abscissa of Rs; angle β is the basal angle of the first submarginal cell, between the first abscissa of vein Rs and Rs+M.

fined, linear, rarely punctiform in or absent from minute species; first recurrent vein entering first submarginal cell or rarely interstitial with the first transverse cubital)

- First abscissa of vein Rs oblique, angles α and β acute (except in an unnamed *Brachyhesma*); lower end of eye (except in *Hypheuma* and males of *Brachyhesma*) not protruding above mandible, upper or anterior mandibular articulation therefore usually in line with inner orbit; posterior margin of first submarginal cell sinuate except in *Brachyhesma* and *Euryglossa hemixanthia* 2
- Second transverse cubital vein about one-third longer than first; costal margin of second submarginal cell sloping apically toward costa; labrum of female with strong apical spine (mandible of female bidentate, rarely simple) *Pachyprosopis*
- Second transverse cubital vein (in some cases absent) little longer than first (except in *Euryglossina narifera* and some specimens of *Euryglossula fultoni* and others); costal margin of second submarginal cell therefore subparallel with costal margin of stigma; labrum without apical spine. (Minute species.) 3
- Basitibial plate of female defined, though in some cases very indistinctly, about one-fourth of length of tibia; eye of female protruding mesad over mandible but little; clypeus of female not strongly sloping inward but forming continuous arc with supraclypeal area as seen in profile; antennae of both sexes very short, median flagellar segments markedly broader than long; marginal cell pointed on costa itself; inner apical mandibular tooth of female simple *Euryglossula*
- Basitibial plate of female not clearly defined but margin indicated, often vaguely, by tubercles and ending near middle of tibia; eye of female strongly protruding mesad over mandible (except in *Microdontura*); clypeus of female sloping inward, at least below, usually at distinct angle to supraclypeal area; antenna of male with median flagellar segments as broad as long or nearly so; marginal cell with apex separated from costa by distance in some cases less than width of a vein; inner apical mandibular tooth of female often notched so that mandibles appear slightly tridentate *Euryglossina*
- Clypeus more than four times as broad as long, seen from front; scape at least two-

- thirds as long as eye; antennal bases more than three times as far from median ocellus as from lower edge of clypeus; eye of male produced mesad above upper mandibular articulation. (Minute, largely yellow forms, antennae immediately above epistomal suture.) *Brachyhesma*
- Clypeus less than four times as broad as long; scape usually not much more than half as long as eye; antennal bases not much more than twice as far from median ocellus as from lower edge of clypeus; eyes of male not produced mesad above upper mandibular articulation 5
5. Costal margin of second submarginal cell distinctly sloping apically toward costa, cell having more or less the same shape as that of *Pachyprosopis*; eyes of female strongly protruding mesad above anterior mandibular articulation . . . *Hyphesma*
- Costal margin of second submarginal cell subparallel to costal margin of stigma¹; eye not protruding mesad above anterior mandibular articulation (except in *Euryglossa hyphesmoides*) 6
6. Mandible of female tridentate (male unknown); wholly black, slender, first tergum about as broad as long seen from above; inner hind tibial spur finely ciliate; distal part of pygidial plate narrower than last tarsal segment *Heterothesma*
- Mandible bidentate or simple; first tergum much broader than long or body largely yellow; if distal part of pygidial plate narrower than last tarsal segment, then inner hind tibial spur pectinate 7
7. Malar space, measured medially, nearly half as long as broad in female, more than one-third as long as broad in male; prestigma nearly as long as distance from base of stigma to vein r; propodeum seen in profile nearly all vertical, only a short sloping zone basally; body robust, head and thorax coarsely and closely punctate. (Eyes strongly converging below) . . *Dasyhesma*
- Malar space in almost all cases virtually absent, rarely longer than broad; prestigma distinctly shorter than distance from base of stigma to vein r; propodeum seen in profile usually with rather long subhorizontal or sloping basal area (except in *Euryglossa*, subgenus *Dermatothesma*); body more slender (except in *Dermatothesma*), head and thorax usually rather sparsely or finely punctate 8
8. Basitibial plate in both sexes indicated by two rows of large tubercles, the rows nearly meeting and terminating the "plate" well beyond middle of tibia; median ocellus closer to antennae than to posterior edge of vertex in female, midway between these points in male *Holohesma*
- Basitibial plate not extending beyond middle of tibia although a row of tubercles may extend beyond middle; vertex less produced posteriorly so that median ocellus is at or behind midpoint between antennae and posterior edge of vertex in female and behind midpoint in male 9
9. Median ocellus of female nearly midway between antennal bases and posterior edge of vertex, male with anterior edge of ocellus near midpoint; body of female strongly metallic; pygidial plate of female exceedingly narrow posteriorly, much narrower than last tarsal segment, upturned apically *Stilpnosoma*
- Median ocellus far behind midpoint between antennal bases and posterior edge of vertex or, if not, as in *Euryglossa terminata*, then body not at all metallic; pygidial plate apically about as broad as last tarsal segment, not upturned 10
10. Mandible simple in both sexes; body slender, first metasomal tergum seen from above little broader than long. (Extensive yellow pattern on body.) *Stenohesma*
- Mandible commonly with subapical tooth, in some cases not evident if mandible badly worn; body of ordinary form, with first metasomal tergum seen from above much broader than long 11
11. Clypeus with strong longitudinal median carina; mandible simple (male unknown) *Melittosmithia*
- Clypeus without longitudinal carina; mandible in nearly every case with subapical tooth 12
12. Lateral fovea on second tergum linear; body length about 3 mm.; integument largely yellow; male with deep vertical groove on each side of face about midway between antennal base and eye; mandible simple in female *Xanthesma*
- Lateral fovea on second tergum broad or unrecognizable, if linear, eyes converging above; body length more than 3 mm. except for a few black species; male without lateral facial groove; mandible with subapical tooth (rarely simple in males of *Euryglossa*, *sensu stricto*). *Euryglossa*

¹ Slightly sloping toward costa in *Holohesma semisericea* and *Euryglossa sinapina*.



FIGS. 223-226. Wings of the Euryglossinae. 223. *Euryglossa* (*Euryglossa*) *subsericea* (scale line represents 5 mm.). 224. *E.* (*Euhesma*) *flavocuneata* (scale line represents 5 mm.). 225. *E.* (*E.*) *goodeniae* (scale line represents 1 mm.). 226. *E.* (*Dermatohesma*) *abnormis*.

EURYGLOSSINAE (MOSTLY *Euryglossa*, SUBGENUS *Euhesma*) NOT PLACED IN THE PRESENT CLASSIFICATION

catanii Rayment, 1949a (*Euryglossa*) (desc.)
celmisiae Rayment, 1949a (*Pachyprosopis*) (desc.)
endeavouricola Strand, 1921 (*Euryglossa*) (desc.)
nigrocyanea Rayment, 1935 (*Euryglossa*) (fig. only)
tarsata Alfken, 1907 (*Euryglossa*) (desc.)

It seems likely that *Allodape grisea* Alfken, 1907, belongs in *Euryglossa*.

GENUS EURYGLOSSA SMITH

Plate 5, figures 5-12; plate 6, figures 1-12;
 text figures 223-272

This is a large and diversified genus the groups of which seem to merge or nearly so and are therefore not given generic status in spite of their diversity. Since the important characters are given under the subgenera and in the keys to the genera and subgenera, a detailed characterization, which would be rather vague because of the diversity of the genus, is omitted.

Nests are burrows made in the soil (either horizontal or banks) or in termite nests. Cells are at the ends of the burrows, usually isolated instead of in series as in the Hylaeinae. Unlike cells of the Hylaeinae, those of the Euryglossinae known to me are homomorphic (all of the same shape, instead of somewhat irregular according to the shape of the cavity as in the Hylaeinae). The cell lining is membranous but less transparent and perhaps weaker than that of the Hylaeinae. Nests of the subgenus *Euryglossa* have been described by Hacker (1918), Rayment (1948b, 1949b), and Michener (1960c), while those of the subgenus *Euhesma* have been described by Rayment (1927c, 1935).

KEY TO THE SUBGENERA OF *Euryglossa*

1. Anterior end of scutum nearly as broad as scutal width at anterior ends of tegulae, curved down rather sharply so that there is a short anterior surface usually distinctively sculptured; scutum coarsely punctured, in female with large shining interspaces or impunctate areas; basitibial area of female demarked by large tubercles (or carinae

- basally), heavy tubercle marking end of area one-third to one-half of distance from base to apex of tibia; inner tibial spur of female strongly pectinate. (No yellow maculations.) *Euryglossa*, *sensu stricto*
- Anterior end of scutum much narrower than width at anterior ends of tegulae, usually curved down rather uniformly, anterior face, if recognizable, rarely distinctively sculptured; scutum usually dull with minute roughening; basitibial area often without large tubercle marking apex; inner hind tibial spur ciliate, serrate, or briefly pectinate (except in *Parahesma*) 2
2. Apex of marginal cell bent well away from wing margin; integument black with yellow markings, rarely almost wholly yellow; inner hind tibial spur of female strongly pectinate; outer surface of hind tibia of female covered with simple bristles *Callohesma*
- Apex of marginal cell not or little bent away from wing margin, apex separated from margin by little if any more than one vein width; integument variable; inner hind tibial spur in some cases pectinate but usually serrate or even ciliate; outer surface of hind tibia of female usually with some plumose hairs in addition to simple bristles 3
3. Eyes of male strongly converging above, separated from lateral ocelli by less than ocellar diameter; arolia of male very large, exceeding claws; eyes of female somewhat converging above; claws of female simple; wings largely bare, at least basally . . . *Xenohesma*
- Eyes parallel or diverging above, rarely slightly converging in females (as in *altitudinis* and *ridens*); arolia normal; claws of female cleft or with inner tooth, rarely simple; wings usually with widely dispersed hairs . . . 4
4. Basitibial area (female) margined by large tubercles, reaching middle of tibia, apex indicated by a strong tubercle; disc of scutum almost impunctate and brilliantly shiny *Parahesma*
- Basitibial area shorter or apex not marked by tubercle [except in (*Euhesma*) *palpalis*], area not usually marked primarily by tubercles; scutum usually minutely roughened and more or less dull, punctate 5
5. Scutum densely and rather finely punctate; propodeum entirely subvertical as seen in profile *Dermatohesma*
- Scutum with punctures separated by ground which is usually finely lineolate; propodeum with subhorizontal or with slanting basal zone which is usually as long as or longer than metanotum *Euhesma*

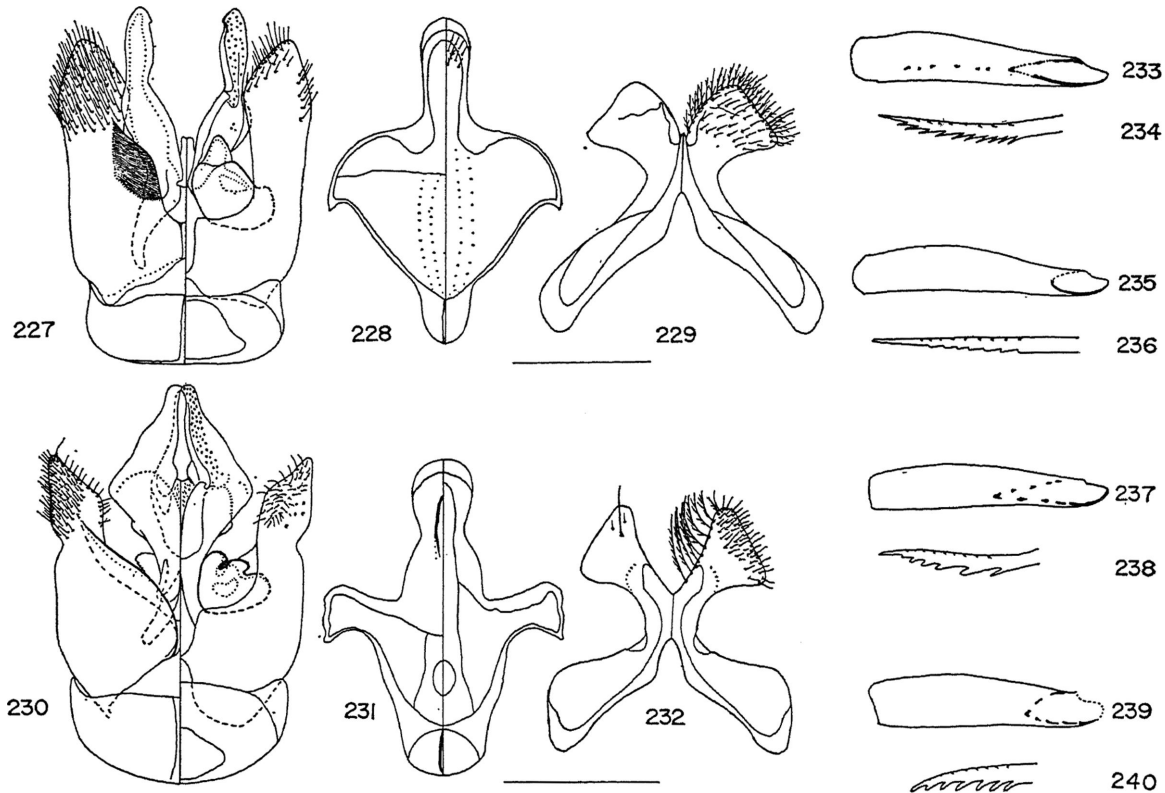
EUHESMA, NEW SUBGENUS

Plate 5, figures 5-12; text figures 224, 225, 227-253

TYPE: *Euryglossa wahlenbergiae*, new species.

This subgenus contains the diversified core of the genus *Euryglossa*; among its many species are forms that approach *Xenohesma* and *Callohesma* as well as several groups that seem best left unnamed but are nonetheless distinctive.

Thorax narrowed anteriorly (see first couplet of key). *Dorsum of thorax minutely roughened and dull between small and widely separated punctures* (except in *crabronica* and *rufiventris* which are coarsely punctate and shining). At least first flagellar segment of male broader than long. Body black or greenish, metasoma rarely red (*rainbowi*, *maculifera*, *rufiventris*, *platyrhina*), in some cases with broken yellow bands or lateral spots (e.g., *flavocuneata*, *undulata*, *crabronica*, *altitudinis*), clypeus and other face marks in some yellow, mesosoma as well as metasoma rarely with extensive yellow markings (*perditiformis*, *australis*). Eyes usually converging below, in some cases parallel, rarely (e.g., *ridens*) slightly converging above; antennae slightly above to slightly below middle of face (far above in *maculifera* and to some degree in *rufiventris*); interantennal distance usually subequal to antennocular distance, markedly less in *maculifera*, greater in *perkinsi*, *wahlenbergiae*, and *palpalis*, more than twice antennocular distance in *platyrhina*; subantennal sutures diverging, parallel or converging above, longer than diameter of antennal socket to very short; facial fovea narrow and distinct (*crabronica*, *serrata*) to broad, indistinct, or virtually absent; basitibial area completely surrounded by a carina (*crabronica*, *hemichlora*, *hemixanthia*), more often open distally and defined by carinae only laterally, carinae uncommonly broken into tubercles as in *fasciatella*; basitibial area one-fifth to nearly one-half as long as tibia; tibia beyond basitibial area rarely (*nigritula*, *fasciatella*) with tubercles; *inner hind tibial spur of female usually coarsely serrate*, in some (e.g., *neglectula*) ciliate, in others (*perkinsi*, *wahlenbergiae*) rather weakly pectinate; claws of female in some cases with large median tooth (as in *Euryglossa*, *sensu stricto*) but more often with



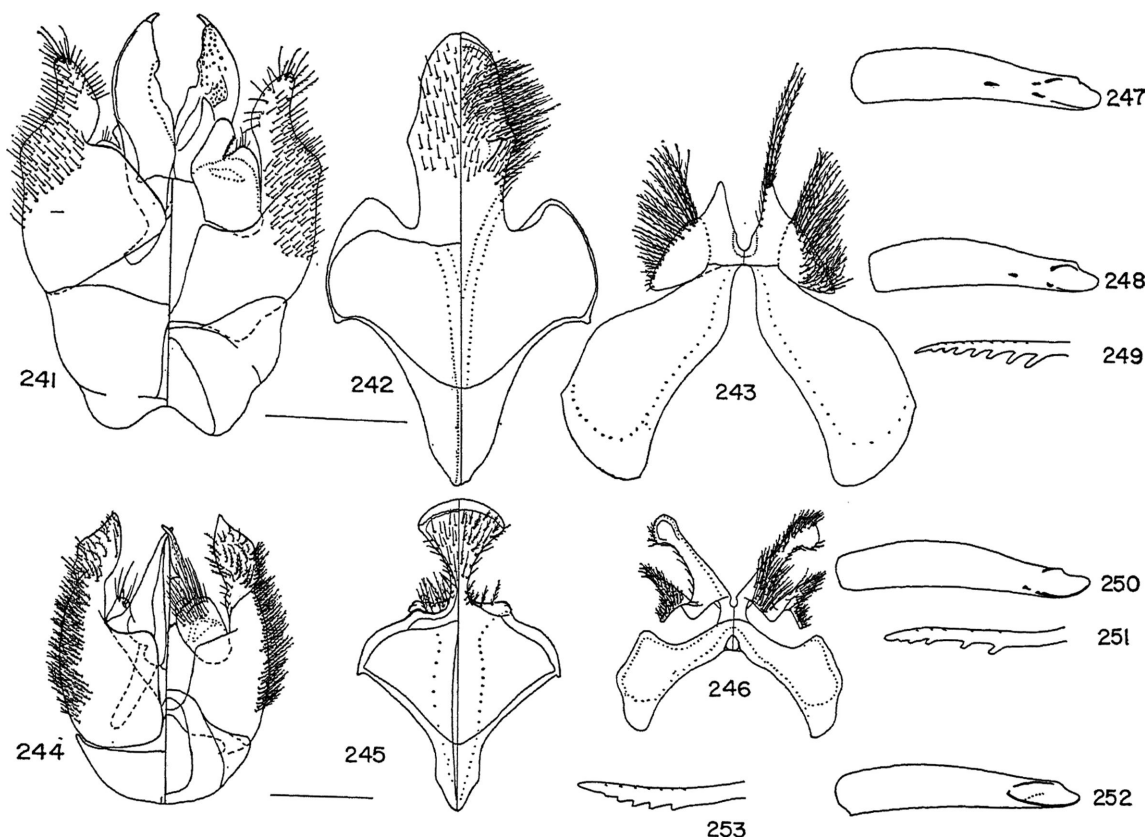
FIGS. 227-240. Euryglossinae. 227-229. Male genitalia and eighth and seventh sterni of *Euryglossa* (*Euhesma*) *neglectula* (scale line represents 0.25 mm.). 230-232. Same of *E. (E.) fasciatella* (scale line represents 0.5 mm.). 233, 234. Outer surface of hind tibia and inner hind tibial spur of female of *E. (E.) neglectula*. 235, 236. Same of *E. (E.) australis*. 237, 238. Same of *E. (E.) palpalis*. 239, 240. Same of *E. (E.) malaris*.

tooth smaller and more nearly parallel to main ramus of claw, tooth small in *hemichlora* and some others and absent so that the claw is simple in *altitudinis*, *australis*, and *malaris*; propodeum with horizontal basal area longer than metanotum (equal to metanotum and sloping in *rufiventris*), prestigma and stigma variable in length; apex of marginal cell almost on costa; fovea of second metasomal tergum often unrecognizable, when recognizable usually large and shallow, three or four times as long as broad.

Some noteworthy variations in the subgenus, not mentioned in the above description, are as follows: Long labial palpi (as long as maxillary palpi) combined with a flattened clypeus occur in *goodeniae*, *palpalis*, and especially *platyrhina*. Progressively more widely separated antennae and more flattened faces

characterize the members of this series, *goodeniae* being quite like other *Euhesma*, and *platyrhina* being so different that were it by itself it could be easily placed in a separate subgenus or genus. *Euryglossa malaris* has even longer labial palpi, but the clypeus is enormously protuberant and, unlike other members of the genus, there is a long malar space.

In *E. flavocuneata* (= *undulata*) the outer surfaces of the hind tibiae of the females lack or nearly lack plumose hairs, as in the subgenus *Callohesma*, which is similar in appearance to this species and may have arisen from similar forms. In *E. crabronica* the second recurrent vein is received two-thirds of the way from base to apex of the second submarginal cell, instead of near the base as in other *Euryglossa*. *Euryglossa maculifera* is unusual



FIGS. 241-253. Euryglossinae. 241-243. Male genitalia and eighth and seventh sterna of *Euryglossa* (*Euhesma*) *wahlenbergiae* (scale line represents 0.25 mm.). 244-246. Same of *E. (E.) crabronia* (scale line represents 0.5 mm.). 247. Outer side of hind tibia of female *E. (E.) perkinsi*. 248, 249. Outer side of hind tibia and inner hind tibial spur of female of *E. (E.) wahlenbergiae*. 250, 251. Same of *E. (E.) rufiventris*. 252, 253. Same of *E. (E.) crabronia*.

in that the first recurrent vein is basal to the first transverse cubital.

The frontoclypeal suture is faint in the flat-faced species, *palpalis* and *platyrhina*, mentioned above and also in an unrelated group of species with bulging, shining faces (*serrata*, *nubifera*, and in *nitidifrons* as usually but incorrectly identified). The clypeus and supraclypeal area are distinctly separated in most species but indistinguishably fused in others. Although this might seem a major feature, closely related species (e.g., *wahlenbergiae* and *perkinsi*) in some cases differ in this characteristic.

Euryglossa dolichocephala is unusual because of the very long head (length is to width as 10/7.5) which is much narrower than the thorax, the short flagellum (basal segments

in both sexes more than twice as broad as long), and the heavy and strongly curved outer hind tibial spur in both sexes.

There is a group of small species with some yellow markings at least in the male and often with the dark areas more or less metallic green. The front basitarsi of the females are short and broad, the inner hind tibial spur is serrate, the facial fovea is absent, and the scape, especially in the male, is short, no longer than the last flagellar segment. An interesting feature of this group is the reduction of the inner tooth of the claw; in males it is smaller than usual; in the female of *hemichlora* it is small, and in females of *altitudinis*, *ridens*, and *australis* the claws are simple. This feature suggests the subgenus *Xenohesma*, and similarities to that group are

also indicated by the fact that eyes of females of *altitudinis* and *ridens* converge slightly above, and in these same species the wings are bare basally. However, the relatively long antennae, and the eyes of the male which converge below, show the relation of the group to *Euhesma*.

In most species the seventh sternum of the male is bilobed, as it is in *Euryglossa*, *sensu stricto*, and related groups without yellow markings. This is true of the smaller species of *Euhesma* with yellow maculations such as *altitudinis*, but in some of the large species with yellow, there are four apical lobes, not necessarily well developed (see figure of *crabronica*). This condition is much as in the yellow-marked subgenus *Callohesma* and is an approach to that found in the genus *Xanthhesma*.

Euryglossa neglectula and *fasciatella* are entirely black species, with the inner hind tibial spur ciliate and with a row of large tubercles along the outer margin of the hind tibia beyond the basitibial area. In these respects they resemble the genus *Heterohesma*, and it is possible that it was derived from such species of *Euhesma*. The discovery of males of *Heterohesma* may shed light on this point.

Euryglossa hyphesmoides is interesting in that the eyes are produced mesad above the mandibular bases as in the genus *Hyphesma*. Other characters also indicate a close relationship to that genus, as indicated in the specific description in Appendix 2.

DISTRIBUTION: Tasmania, Australia north to central Queensland.

INCLUDED SPECIES

- Euryglossa* (*Euhesma*) *altitudinis* Cockerell, 1914 l (B.M.)
anthraccephala Cockerell, 1914b (Q.M.)
australis Michener, new species (C.S.I.R.O.)
crabronica Cockerell, 1914a (Q.M.)
dolichocephala Rayment, 1953b (C.S.I.R.O.)
fasciatella Cockerell, 1907a (A.M.N.H.)
filicis Cockerell, 1926b (N.M.V.)
flavocuneata Cockerell, 1915b (B.M.)
goodeniae Cockerell, 1926a (B.M.)
halictina Cockerell, 1920 (B.M.)
halictoides Rayment, 1939 (C.S.I.R.O.)
hemichlora Cockerell, 1914 l (B.M.)
hemixantha Cockerell, 1914b (Q.M.)
hyphesmoides Michener, new species (Q.M.)

- inconspicua* Cockerell, 1913i (B.M.)
latissima Cockerell, 1914 l (B.M.)
lutea Rayment, 1934 (W.A.M.)
malaris Michener, new species (C.S.I.R.O.)
maculifera, new name for *Melittosmithia maculata* Rayment, 1935, A cluster of bees, p. 653, not *Euryglossa* (*Xenohesma*) *maculata* Smith, 1879 (C.S.I.R.O.)
maura Cockerell, 1927 (U.S.N.M.)
melanosoma Cockerell, 1941 l (B.M.)
mica Cockerell, 1918b (Q.M.)
neglectula Cockerell, 1905e (B.M.)
nigra (Friese, 1924) (*Stilpnosoma*) (not Smith, 1879) (desc.)
nitidifrons Smith, 1879 (B.M.)
nubifera Cockerell, 1922a (Q.M.)
palpalis Michener, new species (C.S.I.R.O.)
perditiformis Cockerell, 1910a (B.M.)
perkinsi Michener, new species (Q.M.)
pernana Cockerell, 1905e (B.M.)
platyrhina Cockerell, 1915b (B.M.)
rainbowi Cockerell, 1929c (A.M.)
ricae Rayment, 1948b (C.S.I.R.O.)
ridens Cockerell, 1913e (B.M.)
rufiventris Michener, new species (C.S.I.R.O.)
serrata Cockerell, 1927 (U.S.N.M.)
subinconspicua Rayment, 1934 (fig. only), 1935 (C.S.I.R.O.)
tasmanica Cockerell, 1918a (B.M.)
tuberculata Rayment, 1939 (C.S.I.R.O.)
undulata Cockerell, 1914j (B.M.)
wahlenbergiae Michener, new species (Q.M.)
walkeriana Cockerell, 1905e (B.M.)

DERMATOHESMA, NEW SUBGENUS

Text figures 226, 254-256

TYPE: *Euryglossimorpha abnormis* Rayment, 1935.

This subgenus appears to represent an offshoot from *Euhesma* in the direction of the genus *Dasyhesma*. It resembles the latter genus almost exactly in appearance, having the same broad body, subvertical propodeal profile, and dull and finely sculptured metasoma with weak apical hair bands on the terga. It differs from that genus, however, in the broader head, short malar areas, more finely punctured scutum, small tooth on the claw, and large stigma (so that the prestigma is distinctly shorter than the distance from the base of the stigma to the base of vein r); in these features it is more like *Euhesma*. It thus seems intermediate between *Euhesma* and *Dasyhesma* and could have been placed almost equally logically as a subgenus of

Dasyhesma or as a subgenus of *Euryglossa* near *Euhesma*. It is currently known from only one female in a bad state of preservation; its position will possibly become much clearer when more material is obtained.

Thorax probably narrowed anteriorly (but damaged in only specimen). *Dorsum of thorax finely and closely punctured, with essentially no interspaces between punctures.* Antenna (female) short, all flagellar segments except last broader than long. Body black, metasoma feebly reddish, with weak, pale, apical hair bands on terga. Eyes strongly converging below; antenna arising slightly above middle of face; interantennal distance slightly greater than antennocular distance; subantennal sutures parallel, less than twice as long as diameter of antennal socket; facial fovea strongly depressed and broadly linear (about as in *Dasyhesma*); basitibial area one-third as long as tibia, defined by carinae on both sides but only by tubercles apically; tibia beyond basitibial area without tubercles, weakly nodulose, with hairs that are provided with numerous short branches; inner hind tibial spur (female) weakly pectinate; claws (female) with small tooth beyond middle (quite unlike those of *Dasyhesma*); propodeum subvertical as seen in profile; prestigma about two-thirds as long as distance from base of stigma to base of vein r; stigma large and rather slender, two-thirds as long as costal edge of marginal cell; apex of marginal cell separated from costal margin of wing by only about the width of a vein; fovea of second metasomal tergum vague, large, nearly two-thirds as long as exposed part of tergum, about three times as long as broad.

DISTRIBUTION: Western Australia.

INCLUDED SPECIES

Euryglossa (*Dermatohesma*) *abnormis* (Rayment, 1935) (*Euryglossimorpha*) n. comb. (C.S.-I.R.O.)

PARAHESMA, NEW SUBGENUS

Plate 6, figure 1; text figure 260

TYPE: *Euryglossa tuberculipes*, new species.

This subgenus resembles a small representative of *Euryglossa*, *sensu stricto*. Although the scutum is narrowed in front of the tegulae, it curves down quite sharply so that the general aspect of the thorax is as in that

subgenus. The basitibial area is also as in that subgenus, although unusually long. The subgenus constitutes a bridge between *Euryglossa* proper and subgenera such as *Euhesma*. The principal distinguishing features are italicized below.

Dorsum of head and of thorax nearly impunctate, shining, nearly smooth. Body dark brown (? in some black), metasoma red; eyes (female) subparallel; antenna below middle of face, interantennal distance subequal to antennocular distance; subantennal sutures somewhat converging above, slightly shorter than diameter of antennal socket; facial fovea slender, impressed; *basitibial area (female) demarked by series of large tubercles, reaching middle of tibia; inner hind tibial spur (female) coarsely pectinate* as in *Callohesma* and *Euryglossa*, *sensu stricto*; *claws of female with small submedian inner tooth* (as in many *Euhesma*, not as in *Euryglossa*, *sensu stricto*); *horizontal area of propodeum longer than metanotum*; prestigma slightly more than half as long as distance from base of stigma to vein r, stigma shorter than costal edge of marginal cell; *apex of marginal cell acute and almost on wing margin* (as in *Euhesma*); wings with hairs throughout; second submarginal cell less than half as long as first; fovea of second tergum between three and four times as long as broad.

This subgenus is known from but one species, and only in the female sex.

DISTRIBUTION: Victoria.

INCLUDED SPECIES

Euryglossa (*Parahesma*) *tuberculipes* Michener, new species (B.M.)

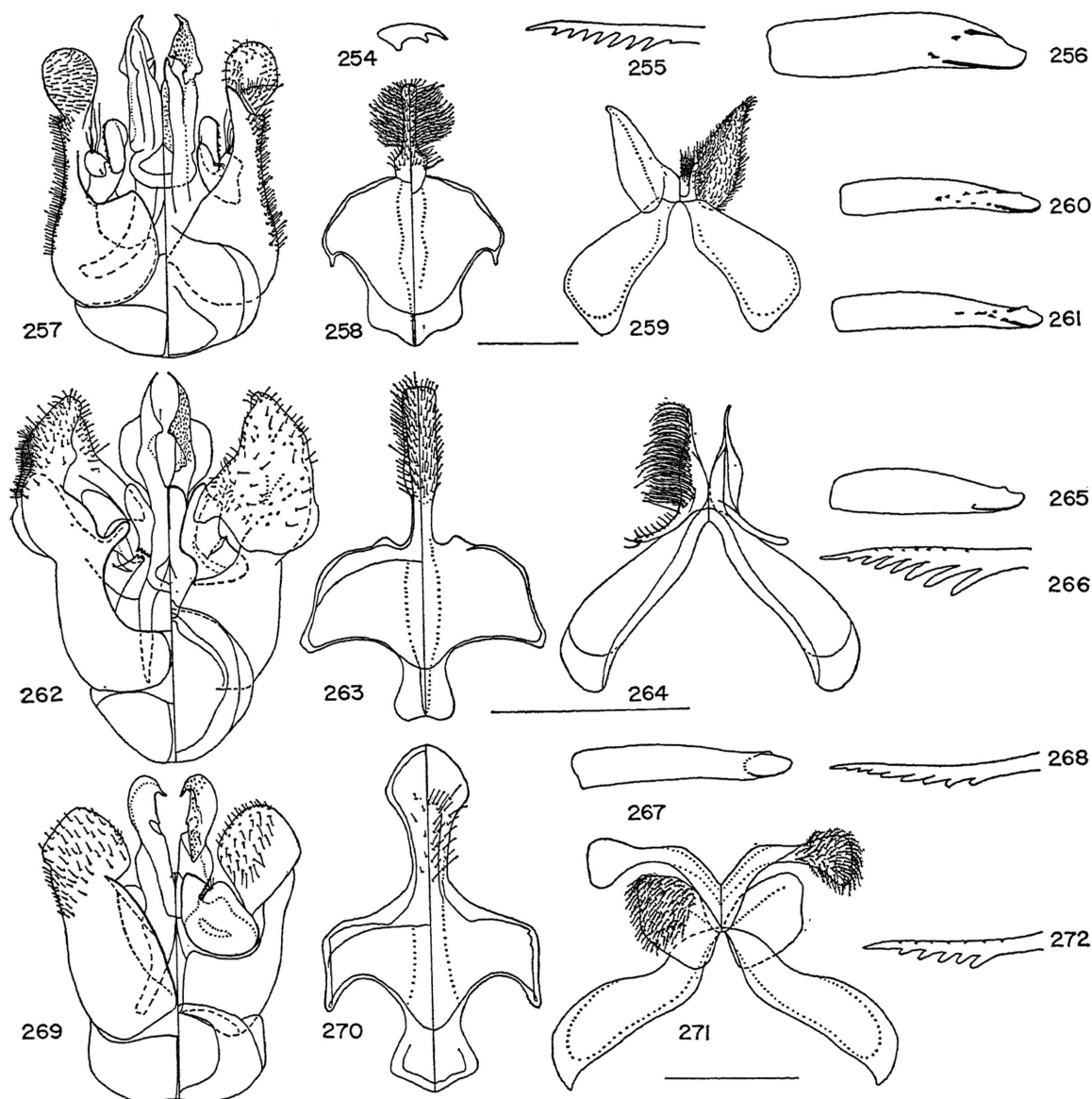
SUBGENUS EURYGLOSSA SMITH, SENSU STRICTO

Plate 6, figures 2, 3; text figures 223, 257-259, 261

Euryglossa SMITH, 1853, p. 17. Type: *Euryglossa cupreoachalybea* Smith, 1853, by designation of Meade-Waldo, 1923, p. 6.

Euryglossimorpha STRAND, 1910, p. 40. Type: *Euryglossa nigra* Smith, 1879 (monobasic). New synonymy.

The type species of *Euryglossimorpha* definitely belongs to the same group as that of *Euryglossa*. In appearance, because of the rather cylindrical shape of the body, this sub-



FIGS. 254-272. Euryglossinae. 254-256. Claw, inner hind tibial spur, and outer surface of tibia of female of *Euryglossa* (*Dermatohesma*) *abnormis*. 257-259. Male genitalia and eighth and seventh sterna of *E. (Euryglossa) proxima* (scale line represents 0.5 mm.). 260, 261. Outer side of hind tibia of female of *E. (Parahesma) tuberculiceps* and *E. (Euryglossa) subsericea*. 262-264. Male genitalia and eighth and seventh sterna of *E. (Callohesma) calliopsiformis* (scale line represents 0.5 mm.). 265, 266. Outer surface of hind tibia and inner hind tibial spur of female of *E. (C.) calliopsiformis*. 267, 268. Outer surface of hind tibia and inner hind tibial spur of female of *E. (Xenohesma) scutellaris*. 269-271. Male genitalia and eighth and seventh sterna of *E. (X.) flavicauda* (scale line represents 0.25 mm.). 272. Inner hind tibial spur of female of *E. (X.) federalis*.

genus is perhaps the most distinctive of *Euryglossa*.

The males of a few species (e.g., *antennata*, *proxima*) have the antennal flagellum elongated and the last segment flattened, expanded.

Important characters of this group are the coarse punctuation of the head and thorax, close in males but with large shining interspaces or impunctate areas on the dorsum of the thorax in females; and the relatively long antennae of the males, the middle segments and usually even the first flagellar segment longer than broad.

Body black without yellow markings, metasoma and parts of thorax in some cases metallic blue or green, metasoma and dorsum of thorax in some cases red. Eyes of female usually parallel, of male converging below; antenna at or slightly below middle of face, interantennal distance equal to (in small species) to less than half (large species) of antennoocular distance; subantennal sutures about as long as diameter of antennal sockets, converging above, at least in females; facial fovea usually linear, broad in females of a few species (*occipitalis*, *bicolor*, *aureomaculata*, *depressa*; intermediate in *tricolor*), absent in *apicalis* (male). Thorax broad anteriorly, as indicated in key to subgenera; basitibial area of female demarked by large tubercles or by carinae basally, heavy tubercle that marks end of basitibial area between one-third and one-half of distance from base to apex, additional tubercles in some cases present along outer edge of tibia beyond large tubercle; inner hind tibial spur of female strongly pectinate as illustrated for *Callohesma*; claws of female with large median tooth so that they are divergently bifid; propodeum largely vertical, horizontal zone rarely wider than metanotum; prestigma more than half as long as distance from base of stigma to vein r; stigma shorter, usually much shorter, especially in larger species, than costal edge of marginal cell; apex of marginal cell usually well separated from costa, especially in larger species, but in some small species, such as *chrysoceras*, apex separated by only about the width of a vein; second submarginal cell more than half as long as first; fovea of second tergum commonly recognizable, three or four times as long as broad.

DISTRIBUTION: Tasmania and Australia

north as far as Darwin and northern Queensland.

INCLUDED SPECIES

- Euryglossa* (*Euryglossa*) *adelaidae* Cockerell, 1905e (B.M.)
albosignata Cockerell, 1929a (A.M.N.H.)
antennata (Rayment, 1935) (*Euryglossimorpha*) n. comb. (C.S.I.R.O.)
apicalis Cockerell, 1913i (U.S.N.M.)
aureomaculata (Rayment, 1949b) (*Euryglossimorpha*) n. comb. (A.M.)
aureopilosa Rayment, 1935 (C.S.I.R.O.)
aurescens Cockerell, 1913i (B.M.)
bicolor Smith, 1862a (B.M.)
chrysoceras Cockerell, 1910i (Berlin*)
cincticornis Cockerell, 1913i (B.M.)
coventryi Rayment, 1935 (C.S.I.R.O.)
cupreochalybea Smith, 1953 (B.M.)
depressa Smith, 1853 (B.M.)
edwardsii Cockerell, 1907a (A.M.N.H.)
ephippiata Smith, 1862a (B.M.)
extrema Rayment, 1935 (C.S.I.R.O.)
frenchii Cockerell, 1910d (B.M.)
haematura Cockerell, 1911a (B.M.)
jucunda Smith, 1879 (B.M.)
lateralis (Friese, 1924) (*Stilpnosoma*) (desc.)
leptospermi Cockerell, 1910d (B.M.)
longicornis Cockerell, 1922a (Q.M.) (type in bad condition; subgenus not certain)
murrayensis (Rayment, 1935) (*Euryglossidia*) n. comb. (C.S.I.R.O.)
myrtacearum Cockerell, 1910a (B.M.)
nigra Smith, 1879 (B.M.)
nigrocaerulea Cockerell, 1913a (U.S.N.M.)
nubilipennis Cockerell, 1914g (B.M.)
obscura Cockerell, 1929d
occipitalis Cockerell, 1922a (Q.M.)
oxleyi (Cockerell, 1905i) (*Halictus*) n. comb (B.M.)
pavonura Cockerell, 1910a (B.M.)
picea (Friese, 1924) (*Stilpnosoma*) (desc.)
politiifrons Cockerell, 1922a (Q.M.)
polysticta Cockerell, 1922a (B.M.)
proxima (Rayment, 1935) (*Euryglossimorpha*) n. comb. (C.S.I.R.O.)
punctata (Rayment, 1935) (*Euryglossidia*) n. comb. (C.S.I.R.O.)
punctata Rayment, 1939 (C.S.I.R.O.), a homonym of above but doubtfully worthy of recognition
reginae Cockerell, 1905e (B.M.)
rhodochlora Cockerell, 1914i (B.M.)
ruberrima Cockerell, 1913a (B.M.)
rubricata Smith, 1879, p. 12 (B.M.)
ruficauda Rayment, 1948b (*Euryglossimorpha*) n. comb. (C.S.I.R.O.)
salaris Cockerell, 1910a (B.M.)

sanguinosa Cockerell, 1913a (B.M.)
schomburgki Cockerell, 1910i (Berlin*)
scutellata Rayment, 1939 (C.S.I.R.O.)
sparsa Cockerell, 1916e (B.M.)
subfusa Cockerell, 1910a (B.M.)
subsericea Cockerell, 1905c (B.M.)
tenuicornis Cockerell, 1913a (B.M.)
terminata Smith, 1853 (Ox.)
thoracica (Friese, 1924) (*Stilpnosoma*) (desc.)
tricolor Smith, 1879 (B.M.)
turneri (Baker, 1906) (*Stilpnosoma*)
turneri (Friese, 1924) (*Stilpnosoma*), not *turneri*
 Friese, 1917, not Baker, 1906) (desc.).
Stilpnosoma turneri Friese is *Euryglossa subsericea* according to Cockerell, 1929b, and therefore need not be renamed. Probably Cockerell referred to *S. turneri* Friese, 1924. Baker (1906) and Cockerell (1910d) validated *S. turneri*, presumably in the sense of *E. subsericea*, as a result of material from Friese bearing his then manuscript name. *Stilpnosoma turneri* Friese, 1917, is supposedly *Stilpnosoma laevigatum*
variabilis Perkins, 1912 (B.M.)
variegata (Friese, 1924) (*Stilpnosoma*) (desc.)
ventralis (Friese, 1924) (*Stilpnosoma*) (desc.)
victoriae Cockerell, 1910a (B.M.)

CALLOHESMA, NEW SUBGENUS

Plate 6, figures 4-7; text figures 262-266

TYPE: *Euryglossa calliopsiformis* Cockerell, 1905.

This is a rather well-defined subgenus of moderate-sized species with yellow maculations, at least on the face, pronotal lobes (except *picta*), and tegulae (except *picta* and *cambournii*) but usually more extensive, and culminating in the wholly yellow body of *sulphurea*. The wing venation (except in the smaller species) is as in *Euryglossa*, *sensu stricto*. The thoracic shape is as in *Euhesma*. Some of the more distinctive features separating this subgenus from *Euryglossa*, *sensu stricto*, or *Euhesma* are italicized below.

Dorsum of thorax minutely roughened, dull or in small species shining, with or without scattered small punctures; antenna of males short, middle flagellar segments slightly broader than long and basal one usually much broader than long; body nonmetallic or essentially so, with yellow markings or wholly yellow, or metasoma rarely partly red (*carinosa*); antenna below middle of face; interantennal distance subequal to antennocular distance; subantennal sutures usually

converging above and about as long as diameter of antennal socket, in smaller species somewhat shorter; facial fovea narrow to moderately broad, distinct or shallow and inconspicuous; *basitibial area of female indicated by a carina posteriorly, otherwise scarcely or not defined*; outer surface of tibia *nodulose and covered with simple bristles, few or no plumose hairs, and lacking tubercles*; *inner hind tibial spur of female strongly pectinate*; claws of female each with large submedian tooth as in *Euryglossa*, *sensu stricto*; propodeum with horizontal area longer to shorter than metanotum; prestigma more than half as long as stigma from base to base of vein r, except in *picta*, *flavopicta*, *sulphurea*, and *lacteipennis*; stigma shorter than costal edge of marginal cell (equal in *sulphurea*); *apex of marginal cell blunt and well away from costa*; second submarginal cell half as long as first or more; fovea of second tergum in some cases recognizable and varying from round to four or more times as long as broad.

The short prestigma and relatively large stigma, seen to a degree in *flavopicta*, *tridentifrons*, and *lacteipennis* and reaching an extreme in *picta* and *sulphurea*, are correlated with relatively small size, somewhat reduced clypeo-antennal distance (except in *lacteipennis*), often greatly expanded yellow markings (*lacteipennis* falling between *flavopicta* and the wholly yellow *sulphurea* in this respect), and the nearly hairless basal parts of the wings (*lacteipennis*, *sulphurea*).

Certain species of *Euhesma* are at least superficially rather similar to *Callohesma*. See the discussion under the former subgenus for comments on these.

DISTRIBUTION: Australia, north to northern Queensland.

INCLUDED SPECIES

Euryglossa (*Callohesma*) *aurantifera* Cockerell, 1912a (Q.M., U.S.N.M.). Both the Washington and Brisbane specimens are labeled "type"; that in Washington, however, has Cockerell's type label on it and is presumably the true type
aureopicta Cockerell, 1929c (A.M.)
calliopsella Cockerell, 1910a (B.M.)
calliopsiformis Cockerell, 1905c (B.M.)
cambournii Rayment, 1939 (C.S.I.R.O.)
campbelli Cockerell, 1929c (A.M.)
carnosa Cockerell, 1913a (B.M.)

euxantha Perkins, 1912 (B.M.)
flavopicta Smith, 1879 (B.M.)
geminata Cockerell, 1911a (B.M.)
lacteipennis Michener, new species (B.M.)
melanothorax Rayment, 1935 (C.S.I.R.O.)
ornatula Cockerell, 1929c (B.M.)
picta (Smith, 1854) (*Allodape*) (B.M.)
quadrifasciata Smith, 1879 (B.M.)
raffae Rayment, 1935 (C.S.I.R.O.)
sinapina Cockerell, 1913a (U.S.N.M.)
sinapipes Cockerell, 1910i (Berlin*)
strigosa Rayment, 1935 (C.S.I.R.O.)
sulphurea Michener, new species (C.S.I.R.O.)
tridentifrons Cockerell, 1913i (B.M.)

XENOHESSMA, NEW SUBGENUS

Plate 6, figures 8-12; text figures 267-272

TYPE: *Euryglossa flavicauda*, new species.

This subgenus is readily distinguished from the others by the eyes, which converge above, very strongly so in the males. It is noteworthy that within the subgenus there are forms (group *a*) in which the fovea of the second tergum is broad as in other *Euryglossa* and others (group *b*) in which the fovea is linear, as in related genera such as *Xanthesma*, *Brachyhesma*, and *Pachyprosopis*. The distinctive four-lobed condition of the seventh sternum of the male, the very short antennae, the convergent eyes, and other characters serve to show the relationships among the forms of *Xenohesma* in spite of the striking differences indicated above and in the subgeneric description. Males of group *a* are covered with dense long hair, absent from group *b*.

Dorsum of head and thorax dull to shining, usually minutely roughened, in some cases with sparse, fine or moderately large punctures; antennae exceedingly short, flagellum almost clavate, especially in male, middle flagellar segments much broader than long (except in *ridens*), in male twice as broad as long. Body nonmetallic, black, with yellow markings; eyes converging above, so strongly so in males that ocellular distance is less than an ocellar diameter; antennae below middle of face, interantennal distance about equal to antennocular distance (less in *flavicauda*); subantennal sutures very short or absent because clypeus reaches antennal sclerite; facial fovea linear to broadly linear (as wide as ocellus) in female, absent from males; basitibial plate of female defined

(weakly so at apex in most species), less than one-fourth as long as tibia, margin not forming tubercles, outer surface of tibia beyond plate nodulose and with sparse, simple bristles, lacking plumose hairs; inner hind tibial spur of female coarsely serrate (almost pectinate) to pectinate; claws of female simple; arolium of male very large, exceeding claws; propodeum with horizontal part longer than metanotum; forewing unusually pointed, hairless at least in basal half; prestigma about half as long as distance from base of stigma to vein *r* or less; stigma slightly shorter than costal edge of marginal cell, apex of marginal cell pointed almost on wing margin (separated from wing margin by about a vein width in *federalis*); fovea of second tergum broad, indistinct (group *b*) or distinct and linear (group *a*); seventh sternum of male with four broad apical lobes.

Euryglossa (*Euhesma*) *ridens* and its relatives appear to bridge the gap between *Xenohesma* and *Euhesma* in various characters. The eyes of the female are slightly convergent above, the basal halves of the wings are bare, and the claws of the female are simple. However, the longer antennae and the bilobed seventh sternum of the male, as well as relations to such more obvious *Euhesma* as *hemichlora*, indicate that the *ridens* group is best placed in *Euhesma*. *Xenohesma* is also similar to *Callohesma*, as indicated not only by the general form and coloration but by the largely bare wings of a few species of that subgenus.

DISTRIBUTION: Australia (probably primarily dry areas) north to northern Queensland.

INCLUDED SPECIES

Euryglossa (*Xenohesma*) (*a*) *blanda* Smith, 1879 (B.M.)

(a) *clypearis* Michener, new species (W.A.M.)

(b) *evansi* Michener, new species (A.M.)

(a) *federalis* Michener, new species (C.S.I.R.O.)

(b) *flavicauda* Michener, new species (C.S.I.R.O.)

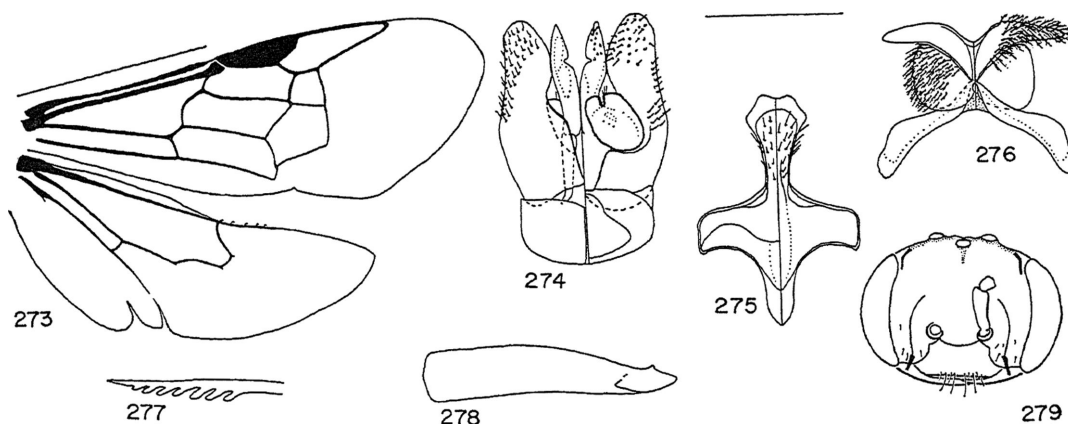
(a) *maculata* Smith, 1879 (B.M.)

(b) *perpulchra* Cockerell, 1916b (B.M.)

(a) *primaria* Michener, new species (C.S.I.R.O.)

(a) *scutellaris* Michener, new species (W.A.M.)

(a) *villosula* Smith, 1879 (B.M.)



FIGS. 273–279. Euryglossinae. *Xanthesma furcifera*. 273. Wings (scale line represents 1 mm.). 274–276. Male genitalia and eighth and seventh sterna (scale line represents 0.25 mm.). 277, 278. Inner hind tibial spur and outer surface of hind tibia of female. 279. Face of male.

XANTHESMA, NEW GENUS

Plate 6, figure 13; plate 7, figures 1, 2; text figures 273–279

TYPE: *Euryglossa furcifera* Cockerell, 1913.

This genus consists of minute yellow or largely yellow bees which resemble small equivalents of *Euryglossa* (*Callohesma*) *sulphurea*. They are also similar superficially to the species of *Brachyhesma* but differ in the ordinary form of the clypeus and the sinuate posterior margin of the first submarginal cell. *Xanthesma* is almost certainly more closely related to small species of *Euryglossa* than to *Brachyhesma*, but differs from *Euryglossa* by the characters italicized below. The closest relationship is to the subgenus *Xenohesma* as is shown, for example, by the seventh sternum (figs. 271, 276).

Body largely impunctate, feebly roughened, shining, partly or wholly yellow; antenna short, middle flagellar segments almost as broad as long in male, broader and in some cases twice as broad as long in female; eyes subparallel or slightly converging below; antennae about twice as far from summit of vertex as from apex of clypeus, interantennal distance subequal to antennocular distance; subantennal sutures absent, clypeus reaching antennal sclerites; facial fovea linear, summit bent mesad toward ocelli, fovea of female more than, and of male less than, half as long as eye; mandible of female simple, of male bidentate; male with vertical arcuate groove in paraocular area between eye and

antennal base, lower end of groove with tuft of long white hair. Thorax narrowed anteriorly; basitibial plate of both sexes weakly defined, or apex not defined, less than one-fourth as long as tibia, margin not tuberculate; surface of tibia beyond plate sparsely nodulose and covered with simple bristles; inner hind tibial spur coarsely pectinate, teeth short; claws of female simple; horizontal part of propodeum much longer than metanotum; prestigma about one-third as long as stigma from base to vein r; stigma slightly shorter than costal edge of marginal cell, latter pointed almost on costa, apex separated from costa by less than a vein width; posterior margin of first submarginal cell sinuate, first recurrent about interstitial with first transverse cubital; second submarginal cell much less than half as long as first. *Fovea of second tergum distinct, linear in both sexes.*

DISTRIBUTION: Australia, north to northern Queensland.

INCLUDED SPECIES

Xanthesma brachycera (Cockerell, 1914e) (*Euryglossa*) n. comb. (B.M.)

flava Michener, new species (C.S.I.R.O.)

furcifera (Cockerell, 1913e) (*Euryglossa*) n. comb. (U.S.N.M.)

nigrior Michener, new species (W.A.M.)

HETEROHESMA, NEW GENUS

Plate 7, figure 3; text figures 280–284

TYPE: *Stilpnosoma clypeata* Rayment, 1954.

This genus contains a single large, slender,

black species. It appears to be a segregate of *Euryglossa* but has a number of noteworthy characters, italicized below. The large size, slender form, quadrate head, and slender and slightly upturned apex of the pygidial plate suggests a relationship to *Holohesma* and *Stilpnosoma*, but the similarities are probably a result of convergence. Closer relationship is probable with *Euryglossa* (*Euhesma*) *fasciatella*, a similarly dull black form with similar fovea, basitibial plate, and clypeocular distance. Only the female is known.

Body black, without maculations; surface dull, with only shallow, widely scattered punctures; eyes converging below except for upper thirds which converge strongly above; mandible tridentate, posterior articulation very far from eye, but anterior articulation separated from eye by distance equal to about one-fourth of breadth of base of mandible, so that there is *small malar area*; labrum without large basal tubercle; clypeus small, separated from eye by more than width of scape (as in some *Euhesma*, in the genus *Euryglossa*), extending but little below lower margins of eyes, apex with large lateral and a smaller median tooth; antennae slightly above middle of face, interantennal distance about half of antennocular distance; subantennal sutures parallel, longer than diameter of antennal socket; median flagellar segments slightly longer than broad; facial fovea scarcely noticeable, upper limits not well defined, very large and broad, width about one-fourth of interocular distance, length about twice width; *genal area slightly wider than eye seen from side*; anterior margin of median ocellus about equidistant between antennal bases and posterior edge of vertex; scutum in front of tegulae slightly narrowed anteriorly; basitibial area less than one-fourth as long as tibia, defined by tubercles, a row of large tubercles extending from apex of basitibial area toward apex of tibia; inner hind tibial spur of female finely ciliate; claws of female with inner preapical tooth as in *Holohesma* and most *Euryglossa*, subgenus *Euhesma*; propodeum seen in profile with sloping basal area about as long as metanotum, curving onto more vertical posterior surface; prestigma distinctly less than half as long as distance from base of stigma to vein r; stigma about seven-ninths as long as costal margin

of marginal cell, *apex of marginal cell pointed on wing margin and remarkably close to wing tip*, distance from apex of cell to wing tip being less than half as long as costal margin of marginal cell; second submarginal cell more than half as long as first; *first metasomal tergum about as broad as long seen from above* (suggestive of *Stenohesma*); *fovea of second tergum large, ill defined and scarcely recognizable*, somewhat longer than broad; *pygidial plate of female narrower than last tarsal segment but broader than in Holohesma and Stilpnosoma, slightly curved upward at apex*.

DISTRIBUTION: New South Wales.

INCLUDED SPECIES

Heterohesma clypeata (Rayment, 1954a) (*Stilpnosoma*) n. comb. (C.S.I.R.O.)

GENUS MELITTOSMITHIA SCHULZ

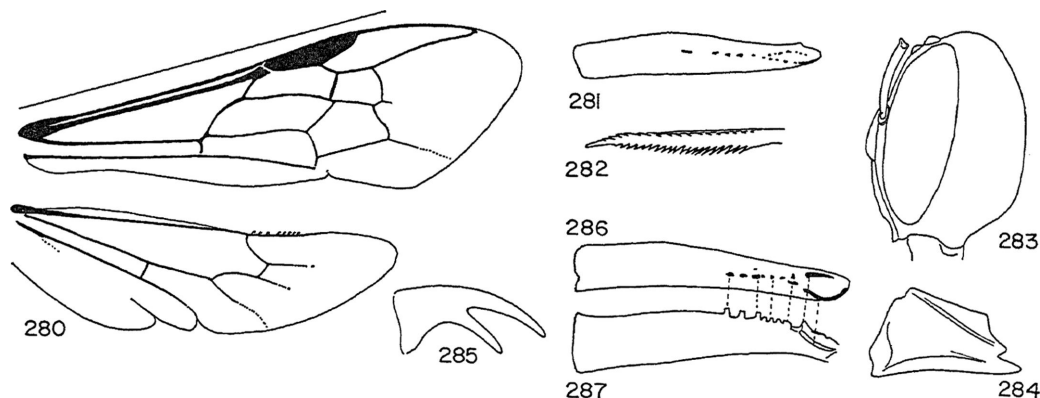
Text figures 285–287

Smithia VACHAL, 1897b (not Milne-Edwards, 1851), p. 63. Type: *Scapter carinata* Smith, 1862 (designation of Cockerell, 1910e, p. 358).

Melittosmithia SCHULZ, 1906, p. 244. Type: *Scapter carinata* Smith, 1862 (autobasic).

This genus includes moderate-sized to large species possibly related to *Euryglossa*, subgenus *Euhesma*, or derived from it, but differing in several characters, italicized below, which seem to segregate it at a generic level. The male is unfortunately unknown to me.

Punctuation sparse and fine, surface between punctures dull to rather shining, minutely roughened. Body nonmetallic, without yellow markings, metasoma partly reddish. Scape reaching anterior ocelli; middle flagellar segments slightly broader than long. Mandibles simple; clypeus with thin, sharp, longitudinal, median carina; eyes (female) slightly converging below, antennae at middle of face, interantennal distance less than antennocular distance; subantennal sutures parallel, as long as or longer than diameter of antennal socket; facial fovea distinct, about as wide as antennal pedicel. Thorax narrowed anteriorly; basitibial area defined by carinae basally, apex open, several high tubercles along outer margin of tibia, one of which may or may not represent apex of basitibial area; *inner hind tibial spur of female ciliate or finely serrate* (unusual in *Euryglossa*



FIGS. 280-284. Euryglossinae. Female of *Heterohesma clypeata*. 280. Wings (scale line represents 5 mm.). 281. Outer surface of hind tibia. 282. Inner hind tibial spur. 283. Side view of head. 284. Mandible.

FIGS. 285-287. Euryglossinae. Female of *Melittosmithia carinata*. 285. Claw. 286, 287. Outer and posterior views of hind tibia.

of such large size); claws with long, divergent, median prong, thus strikingly divergently bifid; propodeum with sloping basal part much longer than metanotum; prestigma less than half as long as distance from base of stigma to vein r; stigma slightly shorter than costal margin of marginal cell; apex of marginal cell pointed on costa; second submarginal cell much shorter than stigma and little, if any, more than half as long as first; fovea of second tergum two and one-half to three times as long as broad.

DISTRIBUTION: New South Wales, Victoria, South Australia.

INCLUDED SPECIES

Melittosmithia adelaidae (Friese, 1924) (*Stilpnosoma*) (desc.)

carinata (Smith, 1862a) (*Scapter*) (B.M.)

froggattiana (Cockerell, 1905e) (*Euryglossa*) (B.M.)

subtilis Cockerell, 1926b (N.M.V.)

Cockerell (1926b) gave a key to the species of the genus.

STENOHESMA, NEW GENUS

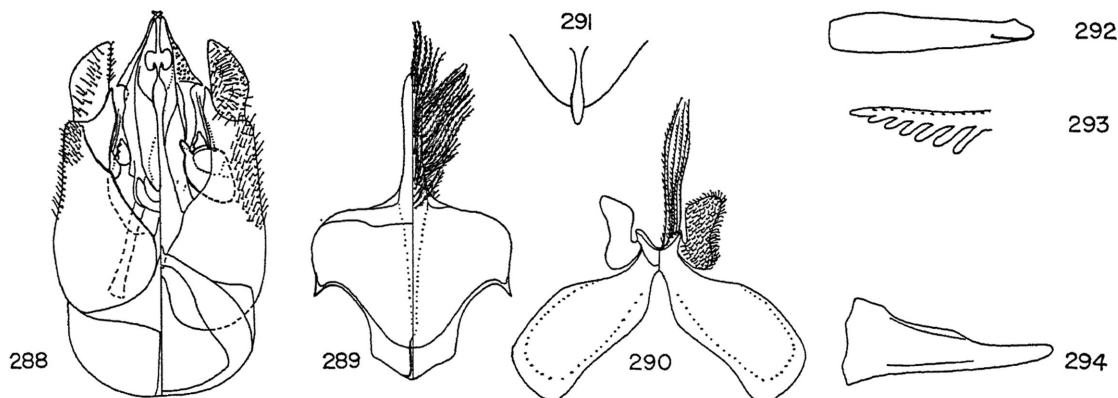
Plate 7, figures 4, 5; text figures 288-294

TYPE: *Stenohesma nomadiformis*, new species.

The species of this genus is moderately large, unusually slender, with extensive yellow markings. It is related to *Euryglossa* and probably particularly to *Euryglossa, sensu*

stricto. Its more notable characters are italicized below. The spaces among the scutal punctures are not smooth as in *Euryglossa, sensu stricto*.

Body somewhat shining but minutely roughened, frons and vertex finely punctate, scutum coarsely punctate. Antenna of female of moderate length, with middle flagellar segments slightly broader than long, of male long, with first flagellar segment about as long as broad and others much longer than broad; mandibles of both sexes with inner tooth scarcely recognizable and one-fourth (male) to one-third (female) of mandibular length from apex, so that mandible appears simple; labrum with transverse basal ridge; eyes of female subparallel, of male slightly converging below; antennal bases at, or in female slightly above, middle of face, interantennal distance less than antennocular distance (one-half in female); subantennal sutures converging above in female, parallel in male, slightly longer than diameter of antennal socket; facial fovea deep and linear, half as long as eye in female, less than one-third as long as eye in male, in female upper end slightly bent in toward lateral ocellus. Thorax but little narrowed anteriorly, almost as in *Euryglossa, sensu stricto*; basitibial area of female demarked by series of strong tubercles, end indicated by large tubercle before middle of tibia, bristle bearing ridge continuing from that point to apex of tibia, basitibial area



FIGS. 288-294. Euryglossinae, *Stenohesma nomadiformis*. 288-290. Male genitalia and eighth and seventh sterna (scale line represents 0.5 mm.). 291. Dorsum of sixth tergum of female. 292, 293. Outer surface of hind tibia and inner hind tibial spur of female. 294. Mandible of female.

and ridge essentially as illustrated for *Stilpnosoma*; basitibial area of male not defined except by posterior carina at base of tibia; inner hind tibial spur of female pectinate; claws with large median tooth as in *Euryglossa*, *sensu stricto*, and *Holohesma*; propodeum with sloping basal zone about as long as metanotum; wings as described for larger species of *Euryglossa*, *sensu stricto*; metasoma slender, first tergum nearly as long as broad, apex of median groove of first tergum anterior to middle of tergum (posterior in other groups); lateral fovea of second tergum large, less than three times as long as broad; pygidial plate of female slender basally and narrowly spatulate apically, not bent upward apically, width before apex subequal to that of last hind tarsal segment.

DISTRIBUTION: Northern Queensland.

INCLUDED SPECIES

Stenohesma nomadiformis Michener, new species (Burns, N.M.V.)

GENUS STILPNOSOMA SMITH

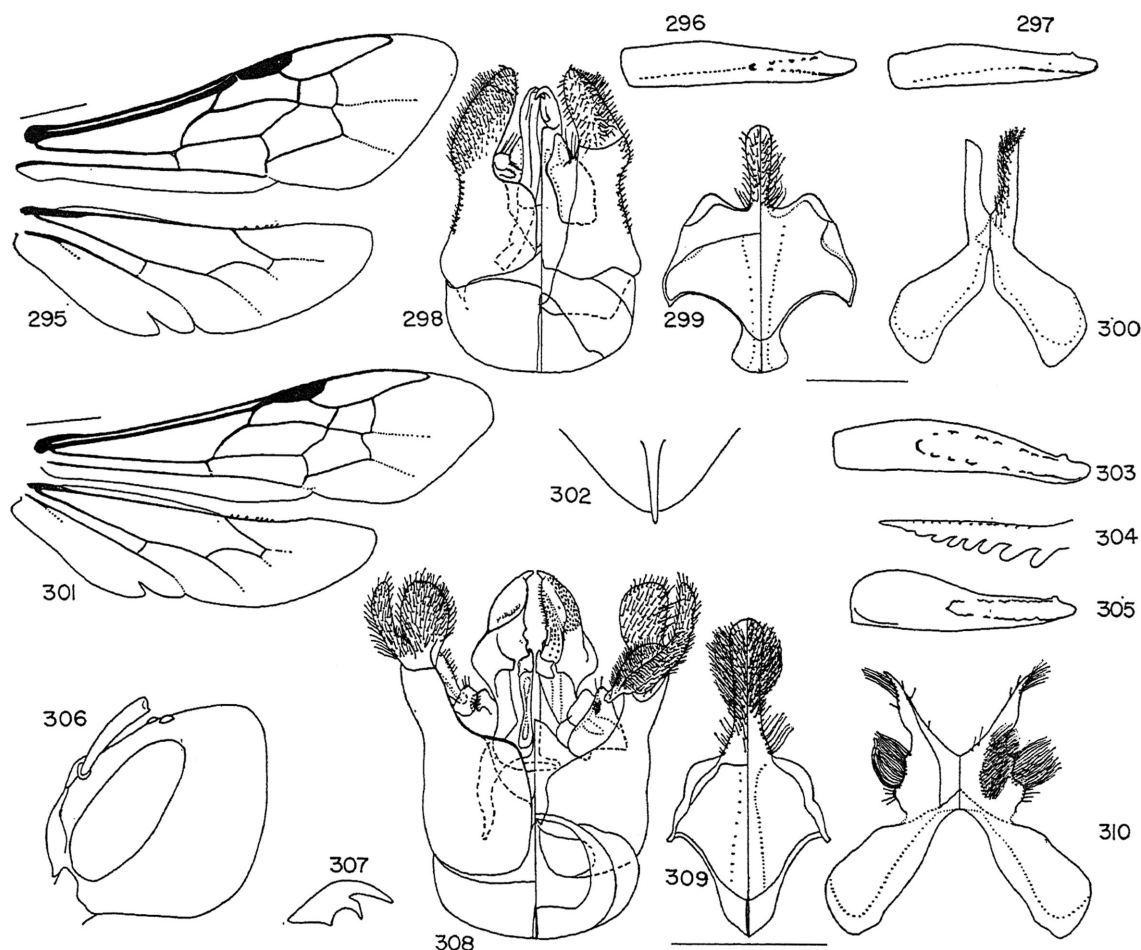
Plate 7, figure 6; text figures 295-300

Stilpnosoma SMITH, 1879, p. 16. Type: *Stilpnosoma laevigatum* Smith, 1879 (monobasic).

The single species of this genus is similar to *Euryglossa*, *sensu stricto*, and it seems possible that it should be included in that group or, more likely, as a subgenus of *Euryglossa*. It differs from that genus, however, in the large postocellar and genal areas and in the

very slender, apically somewhat upturned, pygidial plate of the female. In these characteristics *Stilpnosoma* resembles *Holohesma*, a genus more distinct from *Euryglossa* than is *Stilpnosoma*. The punctation is also similar to that of *Stilpnosoma*, there being widely spaced punctures of moderate size on the head and thorax.

Body of female metallic blue-green, of male black. Eyes converging below, weakly so in female; mandible with subapical inner tooth; labrum with large basal tubercle; antenna near middle of face: interantennal distance in female about half of antennocular distance, the two about equal in male; subantennal sutures converging above, slightly shorter than diameter of antennal socket; median flagellar segments broader than long in female, longer than broad in male; facial fovea linear, about one-third as long as eye in female, more than one-fourth as long as eye in male; postocellar and genal areas much developed posteriorly, genal area of male nearly as wide as eye seen from side, that of female wider; median ocellus of female about midway between antennal bases and posterior edge of vertex (side view), that of male slightly more posterior so that front edge of ocellus is about on midpoint; basitibial area of female not reaching middle of tibia, demarked by large tubercles, a sharp ridge with a row of bristles extending from apex of area to apex of tibia; basitibial area of male less than one-third as long as tibia, anterior margin not demarked;



FIGS. 295-300. Euryglossinae, *Stilpnosoma laevigatum*. 295. Wings (scale line represents 1 mm.). 296, 297. Outer views of tibiae of female and male. 298-300. Male genitalia and eighth and seventh sterna (scale line represents 0.5 mm.).

FIGS. 301-310. Euryglossinae, *Holohesma semisericea*. 301. Wings (scale line represents 1 mm.). 302. Dorsum of sixth tergum of female. 303, 304. Outer side of hind tibia and inner hind tibial spur of female. 305. Outer side of hind tibia of male. 306, 307. Side view of head and claw of female. 308-310. Male genitalia and eighth and seventh sterna (scale line represents 0.5 mm.).

inner hind tibial spur of female pectinate as in *Holohesma*; claws of female with large, inner, divergent tooth; propodeum seen in profile with sloping basal area longer than metanotum, curving onto more vertical posterior surface; prestigma more than half as long as distance from base of stigma to vein r; stigma about two-thirds as long as costal edge of marginal cell; apex of marginal cell separated from wing margin by a little more than a vein width; second submarginal cell nearly half as long as first; fovea of

second tergum poorly defined, less than twice as long as broad in female, two or three times as long as broad in male; *pygidial plate of female with apex forming an upcurved spine* as in *Holohesma*.

DISTRIBUTION: Central and northern Queensland. A record from south Australia is doubtful.

INCLUDED SPECIES

Stilpnosoma laevigatum Smith, 1879 (B.M.)

turneri Firese, 1917, not Baker, 1906, not

Friese, 1924 ("typus," A.M.N.H.). See note under *Euryglossa* (*Euryglossa*) *turneri* Friese, 1924. The "typus" in the American Museum is a male, not a female as Friese indicated.

As the above two names appear to represent a single species, this genus is in reality monotypic.

HOLOHESMA, NEW GENUS

Plate 7, figures 7, 8; text figures 301-310

TYPE: *Stilpnosoma semisericea* Cockerell, 1905.

Distinctive features of this genus are italicized in the following account. The body form is generally parallel sided owing to the large, quadrate head; thus a similarity to *Stilpnosoma* and *Euryglossa*, *sensu stricto*, is suggested. However, the anterior part of the scutum, seen from above, is not parallel sided as in those groups but tapers anteriorly. The large size (7 to 11 mm. long) is also as in those groups. The scattered, rather fine punctures of the dorsum of the head and thorax are as in *Stilpnosoma*, as is the exceedingly slender, apically upturned, pygidial plate. The yellowish brown markings on the thorax and metasoma differ from those of allied genera.

Body black, nonmetallic, with yellowish brown scutellum, metanotum, and apical tergal bands. Eyes of female subparallel below, upper parts diverging below; eyes of male converging below; mandible with sharp, subapical, inner tooth and expanded inner margin basal to tooth; labrum with large, shining, basal tubercle; antennae near middle of face, interantennal distance much less than antennocular distance; subantennal sutures converging above in female and shorter than diameter of antennal socket, in male subparallel and as long as diameter of antennal socket; facial fovea linear, in female more than one-third as long as eye, in male much shorter; *postocellar and genal areas much developed posteriorly, genal area much wider than eye, median ocellus midway between antennal bases and posterior edge of vertex (male) or nearer to antennae (female); basitibial area in both sexes extending beyond middle of tibia and demarked by large tubercles; middle and hind tarsi of male enlarged, basitarsi broadened, hind femur of male with two large posterior tubercles, one of them with tuft of long hair;*

inner hind tibial spur of female coarsely and strongly serrate (or very briefly pectinate); claws of female with large, divergent, median tooth, of male cleft; *propodeum seen in profile sloping, upper portion gently convex*, not even a vague separation of dorsal from posterior surfaces; prestigma about two-thirds as long as distance from base of stigma to vein r; costal margin of marginal cell less than twice as long as stigma; apex of marginal cell separated from costa by about two vein widths; second submarginal cell more than half as long as first, distinctly wider apically than basally; fovea of second tergum less than (female) to more than (male) four times as long as broad; *pygidial plate of female very slender, apically having the form of an upcurved spine; apices of gonocoxites of male deeply bifid.*

DISTRIBUTION: New South Wales to central Queensland.

INCLUDED SPECIES

Holohesma cambournii (Rayment, 1935) (*Stilpnosoma*) n. comb. (C.S.I.R.O.) Illustrations and explanation of plate seem to constitute valid description
histrion (Friese, 1924) (*Stilpnosoma*) n. comb. ("typus" A.M.N.H.)
semisericea (Cockerell, 1905e) (*Stilpnosoma*) n. comb.

Since the three names listed above seem to be synonymous, this genus probably contains only a single species.

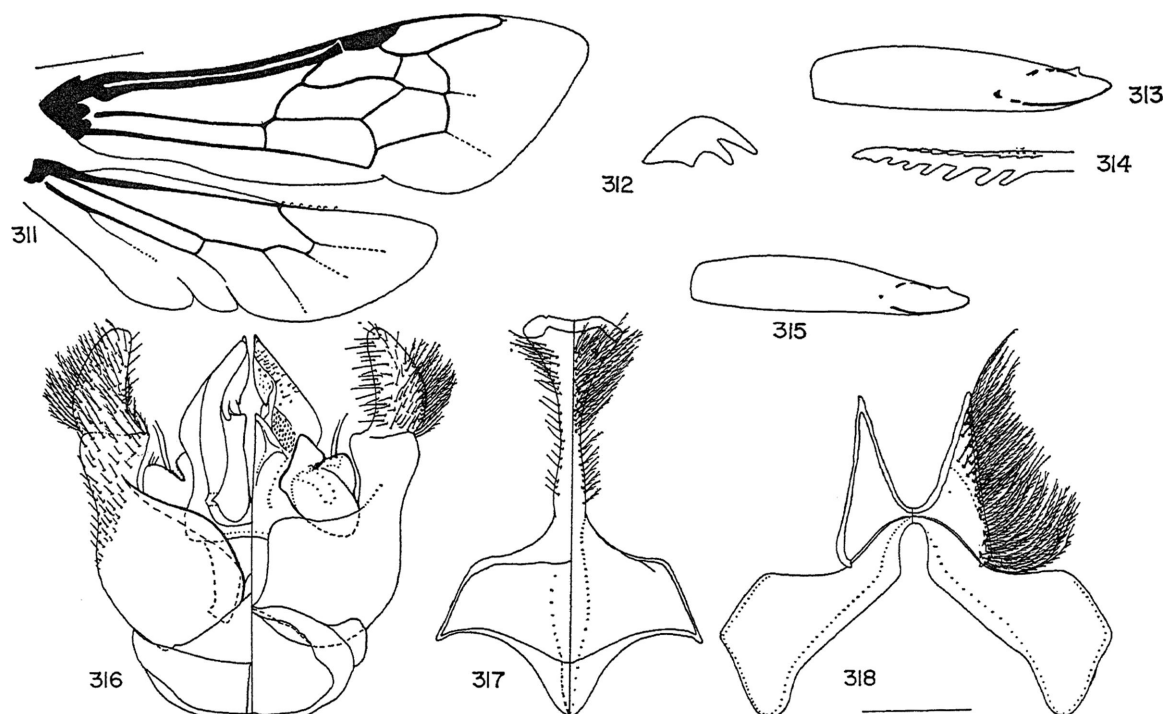
DASYHESMA, NEW GENUS

Plate 7, figure 9; text figures 311-318

TYPE: *Dasyhesma robusta*, new species.

This genus is related to and probably derived from the subgenus *Dermatohesma* of *Euryglossa*, to which it has the closest possible superficial resemblance. It differs from that group by the coarser punctuation of the thorax, the smaller head, shorter eyes so that the malar areas are distinct, smaller stigma so that the prestigma is relatively long, and the large tooth on each claw of the female.

Head and thorax coarsely and rather closely punctate; antenna relatively slender, middle flagellar segments slightly broader than long in female, about as broad as long in male. Head and thorax black, nonmetallic,



FIGS. 311–318. Euryglossinae, *Dasyhesma robusta*. 311. Wings (scale line represents 1 mm.). 312. Claw of female. 313, 314. Outer surface of hind tibia and inner hind tibial spur of female. 315. Outer surface of hind tibia of male. 316–318. Male genitalia and eighth and seventh sterna (scale line represents 0.25 mm.).

metasoma black to red, yellow markings absent, body much more densely hairy than usual in the Euryglossinae; mandible with a broad subapical tooth only weakly separated from apical tooth; head small, narrower than scutum; eyes strongly converging below, not produced mesad above mandibular base, not reaching mandibles; antennal bases above middle of face; *malar area one-third to one-half as long as wide*; interantennal distance slightly less than antenncular distance in female, slightly more than antenncular distance in male; subantennal sutures converging above in female, slightly diverging above in male, less than twice as long as diameter of antennal socket; facial fovea broad linear, about one-third as long as eye; anterior part of scutum narrowed anteriorly, not parallel sided as in *Euryglossa*, *sensu stricto*, and *Stilpnosoma*; basitibial area of female much less than half as long as tibia, open apically, of male probably more than one-third as long as tibia, doubtfully indicated by tubercles apically; inner hind tibial spur of female pectinate with six or seven short teeth; claws

of female with large, diverging, inner tooth, of male cleft; propodeum seen in profile with narrow, steeply sloping, basal zone, narrower than metanotum, before vertical posterior surface; *prestigma nearly as long as stigma from base to base of vein r*; *costal edge of marginal cell about 1.7 times as long as stigma*; apex of marginal cell narrowly rounded and separated from wing margin by two or three vein widths; second submarginal cell more than half as long as first, strongly narrowed toward marginal cell; fovea of second tergum broad and shallow, less than three times as long as broad.

DISTRIBUTION: Western Australia.

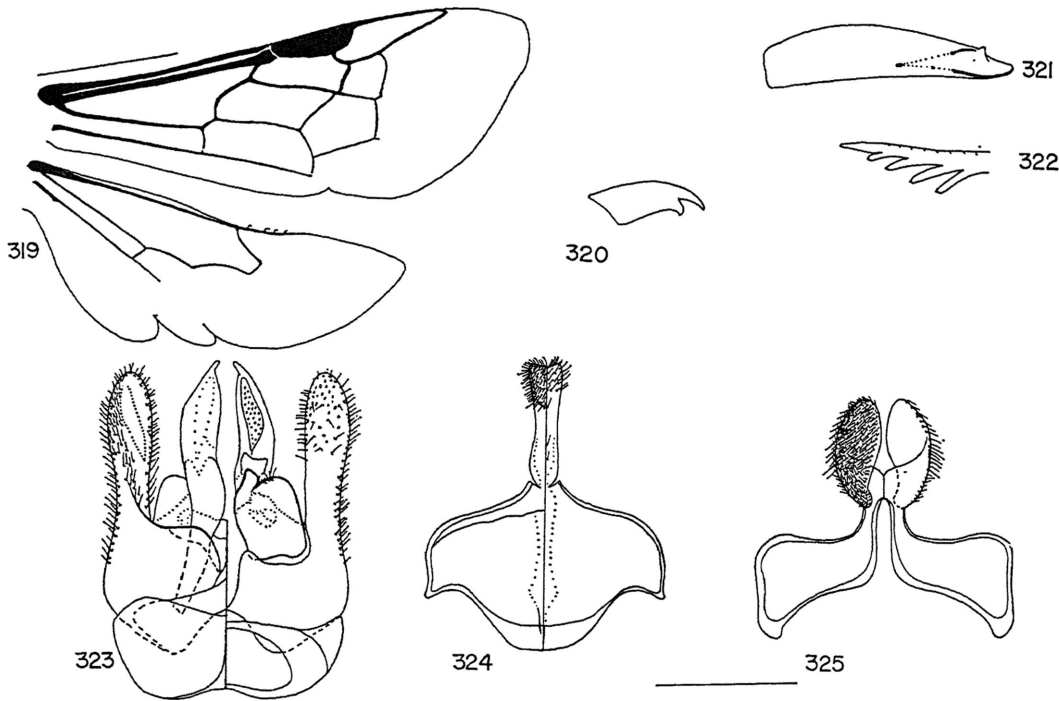
INCLUDED SPECIES

Dasyhesma robusta Michener, new species (W.A.M.)

HYPHESMA, NEW GENUS

Plate 7, figures 10, 11; text figures 319–325

TYPE: *Pachyprosopis atromicans* Cockerell, 1913.



FIGS. 319-325. Euryglossinae. 319. Wings of *Hyphesma barbata* (scale line represents 1 mm.). 320-322. Claw, outer surface of hind tibia, and inner hind tibial spur of *H. niviciceps*. 323-325. Male genitalia and eighth and seventh sterna of *H. barbata* (scale line represents 0.25 mm.).

The species of this genus have the appearance of rather small black species of *Euhesma*, with which they agree in the venational characters listed in the first couplet of the key to the genera. The second submarginal cell is shaped as in *Pachyprosopis*, however, and the lower mesial extremities of the eyes of the female extend mesad over the mandibular bases, in a more exaggerated way than in *Pachyprosopis*, about as in most *Euryglossina*.

Head and thorax smooth and shining between widely separated and in some areas large punctures; antenna of female short, middle flagellar segments much broader than long, of male somewhat longer, same segments slightly broader than long. Body black, nonmetallic, without yellow markings, male and especially face of male quite hairy; mandible with single subapical tooth; *labrum without spine*; eyes strongly converging below (less strongly in male), *in female but not male produced mesad above mandibular bases*; interantennal distance greater than antenno-ocular distance; subantennal sutures diverg-

ing above, at least in male, and shorter than diameter of antennal socket; facial fovea linear, that of male weak and about one-third as long as eye, that of female strong and nearly two-thirds as long as eye, upper end near summit of eye, lower end curved away from eye toward antennal base; basitibial area of female indicated by strong tubercles, apex at middle of tibia, that of male less than one-third as long as tibia, posterior margin and apex complete but anterior margin not defined; *inner hind tibial spur of female pectinate* with four or five large teeth; claws of female with inner, subapical tooth; propodeum with horizontal basal zone about as long as scutellum; prestigma less than half as long as stigma from base to base of vein r; stigma about as long as costal edge of marginal cell, apex of latter pointed almost on costa, separated from costa by a vein width or less; *second submarginal cell shaped as in Pachyprosopis*, usually less than half as long as first and first recurrent vein interstitial with first transverse cubital; *fovea of second*

tergum broad and shallow, less than four times as long as broad.

DISTRIBUTION: Australia north at least to central Queensland.

INCLUDED SPECIES

- Hyphesma atromicans* (Cockerell, 1913a) (*Pachyprosopis*) n. comb. (M.C.Z.)
barbata (Cockerell, 1914b) (*Pachyprosopis*) n. comb. (U.S.N.M.)
elthamensis (Rayment, 1935) (*Euryglossa*) n. comb. (C.S.I.R.O.)¹
nitidiceps (Cockerell, 1912c) (*Pachyprosopis*) n. comb. (B.M.)
oleariae (Rayment, 1935) (*Euryglossa*) n. comb. (C.S.I.R.O.)

The species described as *Euryglossa* (*Hyphesma*) *hyphesmoides* could have been placed in *Hyphesma*, except for the *Euryglossa*-like wing venation. The facial fovea are linear as in *Hyphesma*, but the lower ends are not curved toward the antennal bases.

GENUS PACHYPROSOPIS PERKINS

Plate 7, figures 12, 13; plate 8, figures 1, 2;
 text figures 326-338

This genus can ordinarily be distinguished from all others by the venational characters listed in the first two couplets of the accompanying key. As indicated in the discussion following the description, however, there are a few confusing species for which other characters must be considered.

Head and thorax finely roughened between usually small and often sparse punctures; antennae of both sexes short, middle flagellar segments of male broader than long. Body usually nonmetallic (blue in *haematostoma*), often with metasoma red or with yellow markings. Mandible of female with simple subapical tooth (absent in *flavicauda* so that mandibles are simple); *labrum of female with strong apical spine*; eyes parallel or converging below; antennae below middle of face, interantennal distance varying from one-half of antennocular distance to antennocular distance; subantennal sutures converging above at least in female, equal to or longer than diameter of antennal socket; facial

foveae linear, rather short and inconspicuous in some males; basitibial area variable; inner hind tibial spur of female strongly serrate; claws variable; propodeum with subhorizontal basal zone about as long as metanotum; prestigma usually less than half as long as stigma from base to vein r; stigma about as long as costal edge of marginal cell, apex of latter pointed on or very near costa; *fovea of second tergum linear*.

While this genus is on the whole very distinct, especially on the basis of the shape of the second submarginal cell, it is a surprising finding that it almost grades into *Euryglossina* and *Euryglossula*. One species, *flavicauda*, placed in the group described below as *Pachyprosopula*, is anomalous in that group for various reasons indicated in the description of the subgenus and genus. In form, coloration, and the very short antennae, with the middle flagellar segments twice as wide as long (female), *flavicauda* resembles a large *Euryglossula*. It differs, however, in the tooth on each claw, the labral spine, and the larger basitibial area partially indicated by tubercles. The second submarginal cell is distinctly like that of *Pachyprosopis*, but, as some specimens of *Euryglossula fultoni* have the cell shaped a little like that of *Pachyprosopis*, this character may not be important. However, I believe that there is no really close relationship between *flavicauda* and *Euryglossula*.

The species (*paupercula*) for which the name *Pachyprosopina* is proposed below may show true relationships to *Euryglossina*. It has the size, coloration, and appearance of a member of that genus. Moreover, its simple claws and the nature of the basitibial area (female) are as in *Euryglossina*. The second submarginal cell is only moderately of the *Pachyprosopis* type and could be duplicated in *Euryglossina*. The species differs from *Euryglossina*, however, in the strong labral spine, the simply bidentate mandible, the slightly longer flagellum, and the fact that the clypeus does not slope much inward but is almost a continuation of the curvature of the upper part of the face. It should be noted, however, that there is a species of *Euryglossina* (*narifera*) in which the mandibles are simply bidentate and the second submarginal cell like that of *Pachyprosopis*. It is placed in *Euryglossina* because of the lack of a labral

¹ The head of the type is missing, and some important generic characters cannot, therefore, be checked. However, the placement in *Hyphesma* is probably correct.

spine, the shorter antennae (than in *Pachyprosopis*), the exceedingly *Euryglossina*-like form and maculation, and because the eyes are more sharply produced mesad above the mandibles, as in most *Euryglossina*. Several other species of *Euryglossina* also have bidentate rather than tridentate mandibles.

The paragraph above is based entirely on females, since the species concerned are all known from only one or two females each. When both sexes are known and proper series are available, it may be possible to differentiate the genera more clearly, or it may be necessary to merge them. One species known only in the male, *P. xanthodonta*, may fall in this group of doubtful intermediates.

KEY TO THE SUBGENERA OF *Pachyprosopis*

1. Claws of female cleft, i.e., with inner subapical tooth; thorax, especially in female, not narrowed anteriorly but sides of scutum subparallel in front of tegulae, anterior part of scutum rather abruptly bent downward to form anterior surface; basitibial area of female less than half as long as tibia to extending well beyond midpoint, margin at least apically broken and outline indicated by one to many tubercles; moderate-sized to large species, yellow on body, if present, limited to clypeus, supraclypeal area, and tegula; metasoma often red *Pachyprosopis*, *sensu stricto*
 Claws of female simple or with small inner tooth; thorax narrowed anteriorly (distinction from above not always clear); basitibial area variable; moderate-sized to small species, often with extensive yellow markings, metasoma not red 2
2. Basitibial plate of female complete or margin inconspicuous or absent anteriorly, not developed into tubercles, or with apex broken and marked by one or a few tubercles, length at most little more than one-third of that of tibia; small or moderate-sized species, usually with extensive yellow markings *Pachyprosopula*
 Basitibial plate of female ill defined, apex marked by weak tubercle near middle of tibia as in *Euryglossina*; small species with yellow on body of female limited to face and pronotal lobes. *Pachyprosopina*

SUBGENUS *PACHYPROSOPIS* PERKINS, SENSU STRICTO

Plate 7, figures 12, 13; text figures 326-333

Pachyprosopis PERKINS, 1908, p. 29. Type: *Pachyprosopis mirabilis* Perkins (monobasic).

Several distinctive features of this subgenus are indicated in the preceding key. The apex of the marginal cell is separated by a vein width from the costal margin of the wing. Unlike the other subgenera, the hind tibia of the female is provided with a broad hairless or short-haired band on the outer surface extending from the base to the apex; the basitibial area occupies the proximal part of this band; lateral to the band are the longer hairs of the ordinary vestiture. The basitibial plate of the male is absent.

Species marked *a* in the list below have the basitibial area of the female indicated primarily by tubercles and extending beyond the middle of the tibia; those marked *b* have this area marked in major part by carinae and not attaining the middle of the tibia. Unmarked species are known to me only in the male.

DISTRIBUTION: Australia, north to northern Queensland.

INCLUDED SPECIES

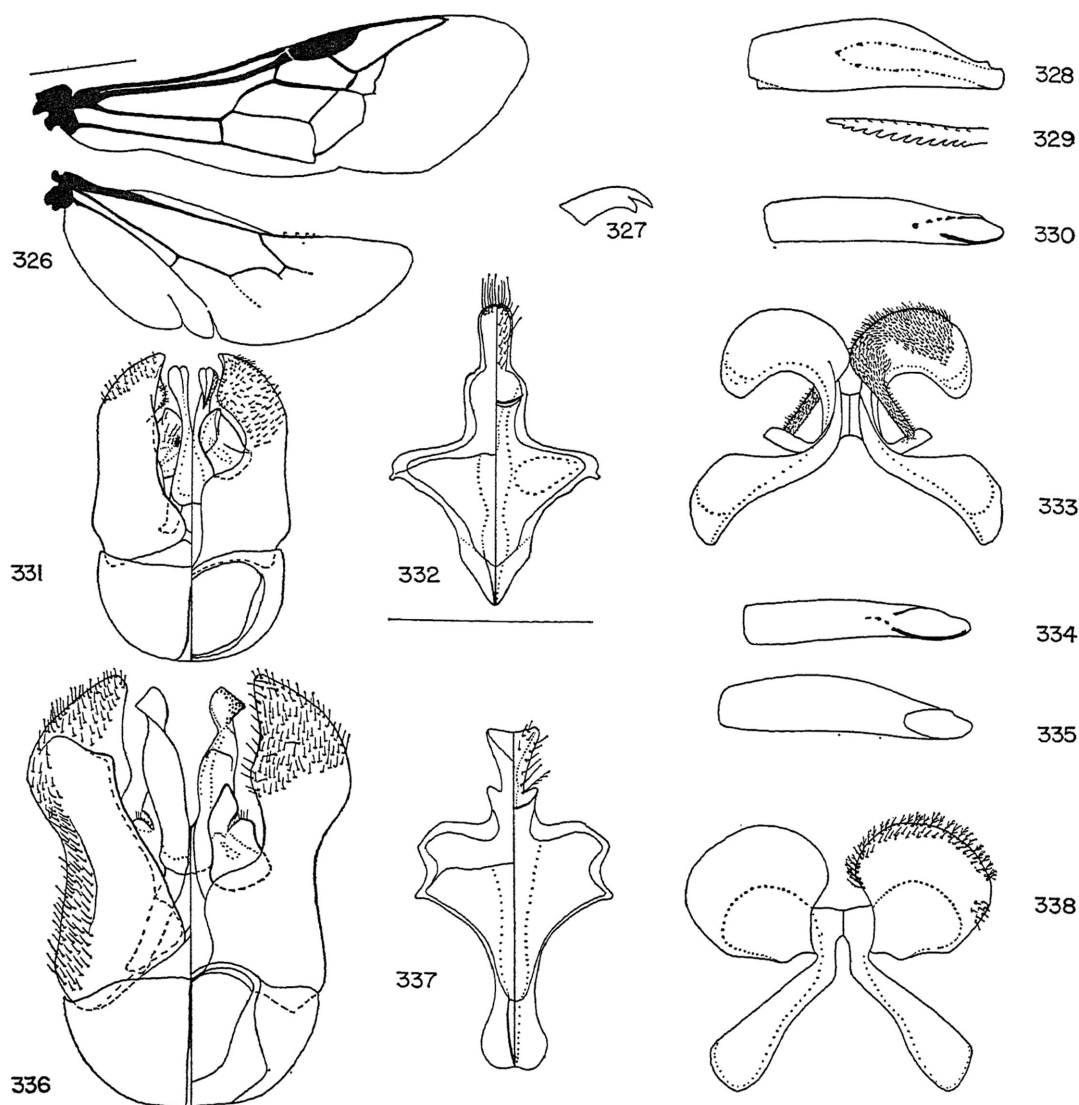
- Pachyprosopis* (*Pachyprosopis*) *angophorae* Cockerell, 1912a (U.S.N.M.)
aurantipes Cockerell, 1913i (B.M.)
 (b) *doddi* Cockerell, 1910d (B.M.)
 (a) *georgica* Cockerell, 1929d (Q.M.)
 (a) *hackeri* Cockerell, 1916d (U.S.N.M.)
 (a) *haematostoma* Cockerell, 1913a (U.S.N.M.)
holoxanthopus Cockerell, 1914i (B.M.)
indicans (Cockerell, 1918b) (type series, U.S.N.M.)
 (a) *mirabilis* Perkins, 1908 (B.M.)
 (b) *obesa* Cockerell, 1912c (B.M.)
 (b) *plebeia* Cockerell, 1910d (B.M.)

PACHYPROSOPULA, NEW SUBGENUS

Plate 8, figures 1, 2; text figures 334-338

TYPE: *Pachyprosopis kellyi* Cockerell, 1916.

Body with yellow markings or largely yellow or fulvous except for *flavicauda* which is almost entirely dark; basitibial area of female complete or margin inconspicuous or absent anteriorly, not tuberculate, about one-fourth as long as tibia (except in *flavicauda* in which it is slightly more than one-third of tibial length and broken and tuberculate apically); basitibial plate of male absent to well defined and about one-third as long as tibia; claws usually with small inner tooth, rarely simple; apex of marginal cell virtually on wing margin. (See also key to subgenera.)



FIGS. 326-338. Euryglossinae. 326. Wings of *Pachyprosopis* (*Pachyprosopis*) *mirabilis* (scale line represents 1 mm.). 327-329. *P. (P.) mirabilis*, female, claw, outer side of hind tibia, and inner hind tibial spur. 330. Outer side of hind tibia of female *P. (P.) plebeia*. 331-333. Male genitalia and eighth and seventh sterna of *P. (P.) mirabilis* (scale line represents 0.5 mm.). 334, 335. Outer side of hind tibia of female of *P. (Pachyprosopula) flavicauda* and *kellei*. 336-338. Male genitalia and eighth and seventh sterna of *P. (P.) angulifera* (scale line represents 0.25 mm.).

DISTRIBUTION: Tasmania and Australia north to southern Queensland.

INCLUDED SPECIES

Pachyprosopis (*Pachyprosopula*) *angulifera* Cockerell, 1929d (Q.M.)
flavicauda Cockerell, 1912a (B.M.)
fulvescens Rayment, 1935 (C.S.I.R.O.)

humeralis Cockerell, 1912a (U.S.N.M.)
kellei Cockerell, 1916b (B.M.)
purnongensis (Rayment, 1935) (*Euryglossina*)
n. comb. (C.S.I.R.O.)
saturina Cockerell, 1913e (U.S.N.M.)
strigata Rayment, 1935 (C.S.I.R.O.)
xanthodonta (Cockerell, 1913e) (*Euryglossina*)
n. comb. (B.M.)

PACHYPROSOPINA, NEW SUBGENUS

TYPE: *Euryglossa paupercula* Cockerell, 1915.

Body dark except for the yellow clypeus (female); basitibial area of female not defined, tibia nodulose, apex of area probably indicated by a tubercle just basad to middle of tibia; claws simple; apex of marginal cell separated from wing margin by about width of a vein. (See also key to subgenera.)

DISTRIBUTION: Western Australia.

INCLUDED SPECIES

Pachyprosopis (*Pachyprosopina*) *paupercula* (Cockerell, 1915b) (*Euryglossa*) n. comb. (B.M.)

GENUS EURYGLOSSINA COCKERELL

Plate 8, figures 3-8; text figures 339-351

This generic name is here used in a sense much broader than previously, to include the forms hitherto listed under the generic names *Turnerella*, *Euryglossella*, *Zalygus*, and *Microdontura*, but excluding a few species segregated for the first time as the separate genera *Euryglossula* and *Brachyhesma*. So constituted, *Euryglossina* is a distinctive group of minute bees, ranging from just over 2 mm. in length to, in exceptional cases, about 5 mm. The proximity to *Pachyprosopis* is indicated in the discussion under that genus.

Body minutely roughened, dull to shining, punctures minute, sparse, commonly absent; antenna short, middle flagellar segments of females much broader than long, of males nearly or about as broad as long, basal flagellar segments in both sexes extremely short. Body black, often with yellow markings on head, more rarely on mesosoma; *mandible with inner apical tooth often notched, so that mandible appears slightly tridentate; labrum without spine*; clypeus of female, seen in profile, usually at distinct angle to supraclypeal area; eyes converging below, rarely subparallel, *lower inner extremities in females narrowly rounded* and, except in *Microdontura*, produced mesad above bases of mandibles as in *Hyphesma*; antennae below middle of face; interantennal distance much less than, to equal to, antennocular distance; subantennal sutures converging above (female) or parallel (male), *longer* (usually much longer) *than diameter of antennal socket*; facial

fovea linear, often small and inconspicuous; basitibial area not defined, apex presumably indicated by tubercle (in some cases very weak) near middle of tibia in female or a little basal to middle in male, outer surface of tibia irregularly nodulose; inner hind tibial spur serrate; *claws of female simple*; propodeum with subhorizontal basal zone usually somewhat longer than metanotum; prestigma much less than half as long as distance from base of stigma to vein r; stigma about as long as costal margin of marginal cell or longer, apex of cell pointed, *separated from wing margin by about width of a vein*; first recurrent vein entering first submarginal cell; fovea of second tergum linear, in some cases very short, punctiform, or absent.

Most of the species in the genus are found in the subgenera *Euryglossina*, *sensu stricto*, and *Turnerella*. These subgenera are very closely allied, differing only by the venational reduction of the latter. Indeed *Turnerella* may not constitute a natural unit, but, like any group differentiated by a few venational losses, may consist of species that have independently lost veins. The extent of reduction of the second submarginal cell varies, and a noteworthy intermediate is provided by *E. intermedia* in which the second recurrent vein is lost (as in *Turnerella*) but the second submarginal cell is complete (as in *Euryglossina*, *sensu stricto*). The other two subgenera, both small, are more different. Both have the marginal cell much shortened, the first recurrent vein shifted basally so that it joins the first submarginal cell a little beyond the middle (*Euryglossella*) or one-third of the length of the cell from the apex (*Microdontura*), and both have the face relatively broad, the eyes of the female subparallel instead of strongly converging below. Probably byproducts of the broadening of the face cause the lower mesal extremities of the eyes of the female of *Euryglossella* to be less sharply rounded than those in the major subgenera; in *Microdontura*, although sharply rounded, these extremities are not above the mandibular bases as in other subgenera. The body of *Microdontura* is more slender than that of other groups.

It seems appropriate to point out here that a genus of pemphredonine wasps was described as *Microglossa* Rayment (1930c) and assigned to the bees. As the name was pre-

occupied, it was changed to *Microglossella* Rayment (1935). As has been indicated by Pate (1937) and subsequent authors, these names are synonyms of *Spilomena*. Rayment's statement that these insects line and provision their cells in the manner of colletid bees is no doubt based on the presence in the same nesting site of small bees, probably *Euryglossina*. Many specimens of *Spilomena* were dissected by me to determine whether or not they were carrying pollen in the crop, as euryglossine bees do. Not one was found with pollen in the crop even when taken from the same flowers on which specimens of *Euryglossina* and *Euryglossula* were abundant and well filled with pollen. It is therefore reasonable to ignore the report of beelike habits for *Spilomena*.

In view of Rayment's account of the nesting of *Microglossella*, it seems likely that *Euryglossina* nests occur in banks of soil. However, Rayment (1955e) recorded a species (under the generic name *Pachyprosopis*) nesting in a telegraph pole.

KEY TO THE SUBGENERA OF *Euryglossina*

1. Second submarginal cell complete 2
Second submarginal incomplete or absent.
(Second recurrent vein absent.) 3
2. Costal edge of marginal cell equal to or slightly longer than stigma; eyes of female strongly protruding mesad over mandibular bases; second recurrent vein usually present, first basad to first transverse cubital by much less than length of second submarginal cell . . .
. *Euryglossina*, *sensu stricto*
Costal edge of marginal cell slightly shorter than stigma; eyes of female protruding but little mesad over bases of mandibles; second recurrent vein absent, first basal to first transverse cubital by distance equal to length of second submarginal cell
. *Microdontura*
3. Costal edge of marginal cell equal to or slightly longer than stigma *Turnerella*
Costal edge of marginal cell much shorter than stigma *Euryglossella*

SUBGENUS *EURYGLOSSINA* COCKERELL, SENSU STRICTO

Plate 8, figures 5, 6; text figures 339, 340,
344-346, 350, 351

Euryglossina COCKERELL, 1910a (Aug.), p. 211.
Type: *Euryglossa semipurpurea* Cockerell, 1910
(monobasic).

DISTRIBUTION: Tasmania, Australia north to central Queensland.

INCLUDED SPECIES

- Euryglossina* (*Euryglossina*) *cockerelli* Perkins,
1912 (B.M.)
flaviventris Cockerell, 1916e (B.M.)
fuscescens Cockerell, 1929d (Q.M.)
hypochroma Cockerell, 1916e (B.M.)
intermedia Michener, new species (Q.M.)
lynettae (Rayment, 1955c) (*Pachyprosopis*) n.
comb. (C.S.I.R.O.)
minuta (Rayment, 1935) (*Euryglossa*) n. comb.
(C.S.I.R.O.)
mutica (Cockerell, 1912a) (*Euryglossa*) n. comb.
(B.M.)
nana Cockerell, 1916e (B.M.)
narifera (Cockerell, 1915b) (*Euryglossa*) n.
comb. (B.M.)
perpusilla Cockerell, 1910k (B.M.)
personata Cockerell, 1929d (Q.M.)
philoxaniha Cockerell, 1929d (Q.M.)
proctotrypoides Cockerell, 1913e (U.S.N.M.)
semiflava Cockerell, 1929d (Q.M.)
semipurpurea (Cockerell, 1910a) (*Euryglossa*)
(B.M.)

SUBGENUS *TURNERELLA* COCKERELL

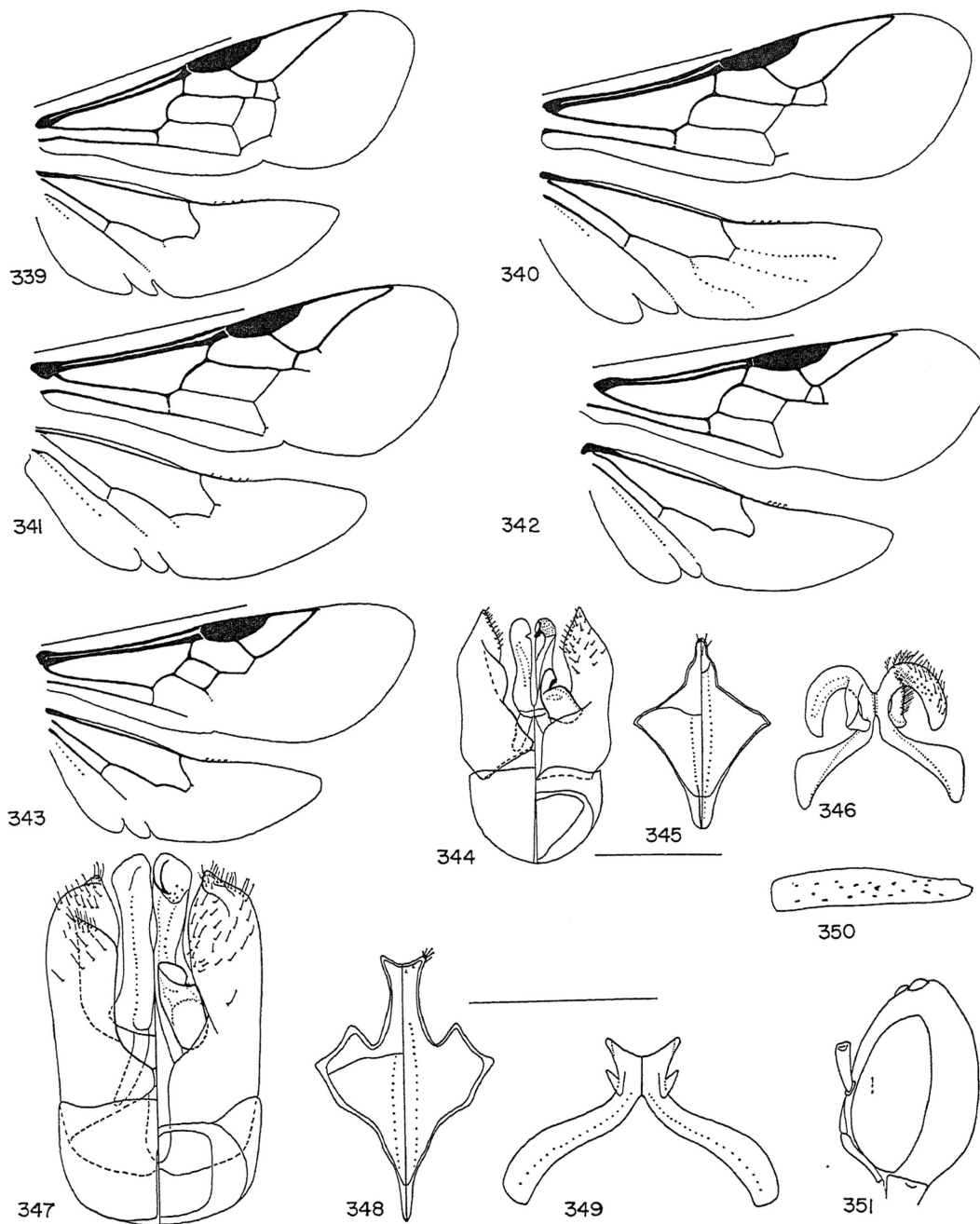
Plate 8, figures 3, 4; text figure 341

Turnerella COCKERELL, 1910k, p. 262. Type:
Turnerella gilberti Cockerell, 1910 (monobasic).

DISTRIBUTION: Australia north to central Queensland.

INCLUDED SPECIES

- Euryglossina* (*Turnerella*) *atomaria* (Cockerell,
1914b) (*Euryglossella*) n. comb. (B.M.)
bicolor (Rayment, 1935) (*Euryglossella*) n.
comb. (Wilson)
doddi (Perkins, 1912) (*Turnerella*) n. comb.
(B.M.)
flavolateralis Michener, new name for *Turnerella*
semiflava Cockerell, 1929d, Mem. Queensland
Mus., vol. 9, p. 320, not *Euryglossina semi-*
flava Cockerell, *ibid.*, vol. 9, p. 318 (A.M.)
fusciventris (Cockerell, 1929d) (*Turnerella*) n.
comb. (Q.M.)
gilberti (Cockerell, 1910k) (*Turnerella*) n.
comb. (B.M.)
glauerti (Rayment, 1934) (*Turnerella*) n. comb.
(W.A.M.)
globuliceps (Cockerell, 1918b) (*Euryglossella*) n.
comb. (Q.M.)
macrostoma (Cockerell, 1929d) (*Turnerella*) n.
comb. (Q.M.)
nothula (Cockerell, 1922b) (*Euryglossella*) n.
comb. (U.S.N.M.)



FIGS. 339-351. Euryglossinae. 339. Wings of *Euryglossina (Euryglossina) flaviventris*. 340. Same of *E. (E.) intermedia*. 341. Same of *E. (Turnerella) nothula*. 342. Same of *E. (Microdontura) mellea*. 343. Same of *E. (Euryglossella) cornuta*. Scale lines for the wings represent 1 mm. in length. 344-346. Male genitalia and eighth and seventh sterna of *E. (Euryglossina) flaviventris*. 347-349. Same of *E. (Euryglossella) cornuta*. 350. Outer surface of hind tibia of female of *E. (Euryglossina) intermedia*. 351. Side view of head of female, *E. (E.) hypochroma*. Scale lines for genitalia and sternal drawings of *E. (E.) flaviventris* and *cornuta* represent 0.25 mm.

pachycephala (Cockerell, 1929d) (*Turnerella*)
n. comb. (Q.M.)
subnothula (Cockerell, 1929d) (*Turnerella*) n.
comb. (Q.M.)
xanthogena (Rayment, 1935) (*Turnerella*) n.
comb. (C.S.I.R.O.)

SUBGENUS EURYGLOSSELLA COCKERELL

Plate 8, figure 7; text figures 343, 347-349

Euryglossella COCKERELL, 1910k (Oct.), p. 263.
Type: *Euryglossella minima* Cockerell, 1910
(monobasic).

Zalygus COCKERELL, 1929d, p. 321. Type:
Zalygus cornutus Cockerell, 1929 (monobasic).
New synonymy.

The type species of *Zalygus* is closely related to that of *Euryglossella*, the only major difference being the presence of two large, lateroapical clypeal projections in the female of the former. They are absent from the male and are indicated by prominences in the female of *E. minima*.

DISTRIBUTION: Queensland (southern and central).

INCLUDED SPECIES

Euryglossina (*Euryglossella*) *cornuta* (Cockerell, 1929d) (*Zalygus*) n. comb. (Q.M.)
minima (Cockerell, 1910k) (*Euryglossella*) n. comb. (B.M.)
perkinsi Michener, new species (Q.M.)

SUBGENUS MICRODONTURA COCKERELL

Plate 8, figure 8; text figure 342

Microdontura COCKERELL, 1929d, p. 322. Type:

Microdontura mellea Cockerell, 1929 (monobasic).

DISTRIBUTION: Southern Queensland.

INCLUDED SPECIES

Euryglossina (*Microdontura*) *mellea* (Cockerell, 1929d) (*Microdontura*) n. comb. (Q.M.)

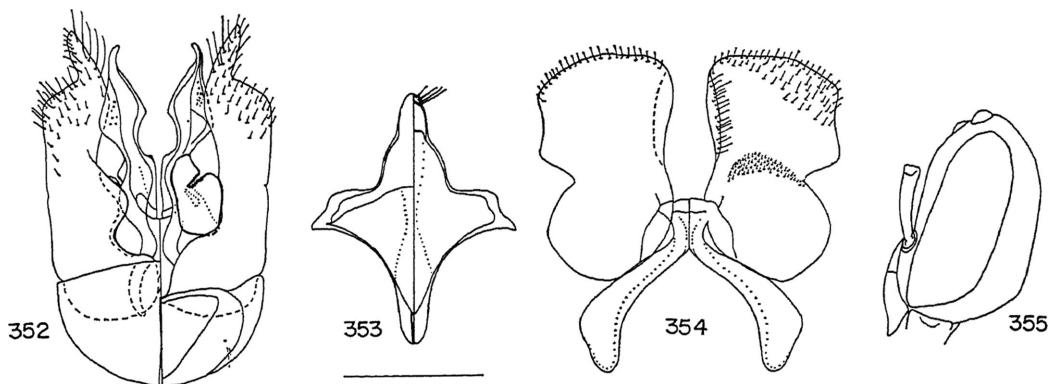
EURYGLOSSULA, NEW GENUS

Plate 8, figures 9, 10; text figures 352-355

TYPE: *Euryglossina chalcosoma* Cockerell, 1913.

This genus is proposed for a group of minute bees previously included in *Euryglossina*. They differ from *Euryglossina* in the broader body and the broader head which is never quadrate as is often the case in *Euryglossina*. In the type species the head and thorax have weak greenish or brassy metallic tints, unlike any *Euryglossina*, but this is not true of all *Euryglossula*.

Euryglossula agrees with the description of *Euryglossina* except as follows: flagellum of male short, median segments markedly broader than long; mandibles with small, subapical, inner tooth which is not notched; clypeus and supraclypeal area of female, seen in profile, forming continuous arc; eye more similar in the two sexes than in *Euryglossina*, lower inner angle protruding less over base of mandible in female, and more in male, than in that genus; subantennal sutures slightly converging above (females) or strongly so (males), little longer than diameter of anten-



FIGS. 352-355. *Euryglossinae*. 352-354. Male genitalia and eighth and seventh sterna of *Euryglossula chalcosoma* (scale line represents 0.25 mm.). 355. Side view of head of female of same.

nal sockets; basitibial plate of female weakly defined, at least posteriorly, about one-fourth as long as tibia; outer surface of tibia only very weakly nodulose; stigma about as long as costal margin of marginal cell; apex of marginal cell pointed on wing margin.

DISTRIBUTION: Australia, north to central Queensland.

INCLUDED SPECIES

- Euryglossula chalcosoma* (Cockerell, 1913e) (*Euryglossina*) n. comb. (B.M.)
claristigma (Rayment, 1935) (*Euryglossina*) n. comb. (C.S.I.R.O.)
fultoni (Cockerell, 1913e) (*Euryglossina*) n. comb. (U.S.N.M.)
microdonta (Rayment, 1934) (*Euryglossina*) n. comb. (W.A.M.)
parazantha (Rayment, 1934) (*Euryglossina*) n. comb. (C.S.I.R.O.)

BRACHYHESMA, NEW GENUS

Plate 8, figures 11–14; text figures 356–366

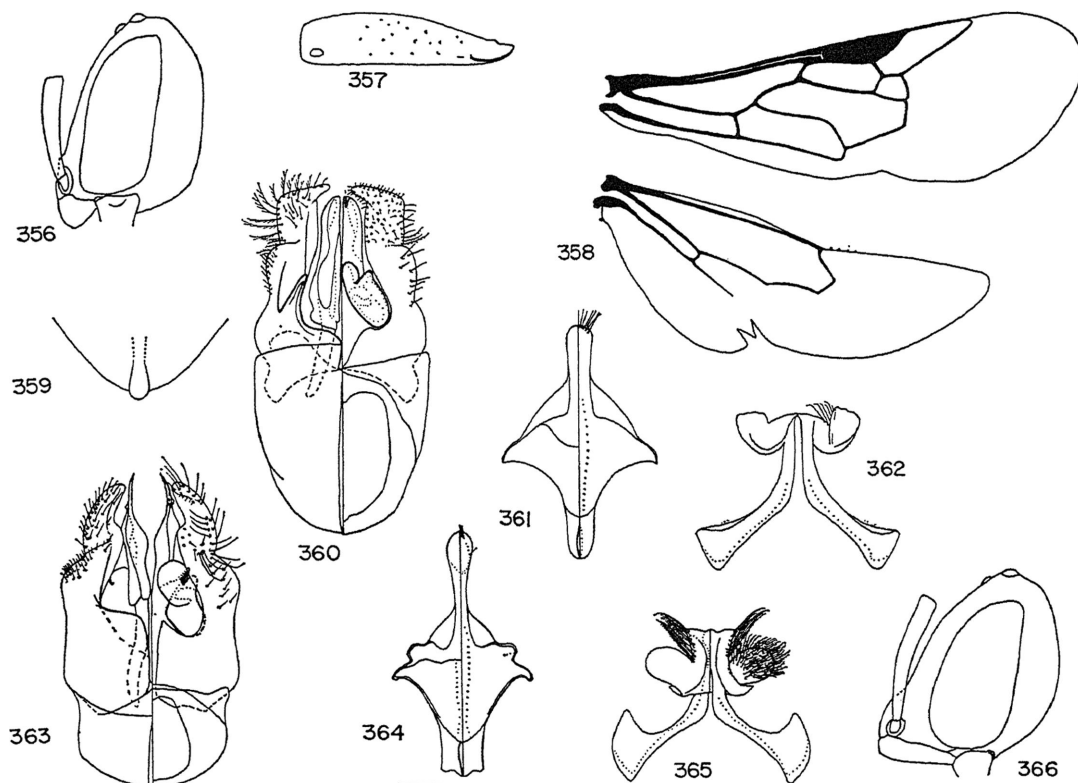
TYPE: *Euryglossina sulphurella* Cockerell, 1913.

This genus is proposed for a group of minute, usually largely yellow bees that has hitherto been included in the genus *Euryglossina*. The characters listed in the first couplet of the Key to the Genera of the Euroglossinae usually separate *Brachyhesma* from *Euryglossina*. However, in an undescribed species (known from one specimen from Victoria, in the collection of the Commonwealth Scientific and Industrial Research Organization) angle β in the forewing is right-angled. *Brachyhesma* is unusual in its exceedingly short, broad clypeus, five or more times as broad as long; in the low position of the antennae on the face, the distance from the antennal sockets to the median ocellus being well over three, and usually more than five, times as great as the distance from the antennal sockets to the anterior margin of the clypeus; and in the fact that the eyes of the male but not the female project mesad above the mandibular bases, much as do the eyes of females (but not males) in *Euryglossina*, *Pachyprosopis*, and *Hyphesma*. These characters also distinguish *Brachyhesma* from the similar small bees of the genus *Xanthesma*.

Body minutely roughened, shining, punctures minute and sparse; antenna short, middle flagellar segments of both sexes much

broader than long. Body wholly or largely yellow or with extensive brown and black areas; mandible bidentate, inner tooth weak (or worn?) in female of *incompleta*; inner orbits diverging below in female, in males lower ends of eyes produced mesad above mandibular articulations so that these orbits, considered as a whole, are subparallel although upper portions diverge below; clypeus very short, more than four to perhaps 10 times as broad as long as seen from front, but in males of *Brachyhesma*, *sensu stricto*, inflexed and with a rather broad ventral surface; antennae below middle of face, about three to about eight times as far from median ocellus as from anterior margin of clypeus; antenna immediately above clypeus so that subantennal suture is absent; facial fovea long and linear in both sexes, in males inconspicuous because it is very near eye margin; basitibial area of female about one-fifth as long as tibia, weakly defined along posterior margin only, that of male similar or unrecognizable; front femur swollen, in male usually about twice as long as wide; outer surface of tibia with only scattered small tubercles; inner hind tibial spur of female coarsely ciliate; hind tibial spurs of male absent or one tibial spur or bristle about as long as tibia present; hind tarsus of male very long, basitarsus often as long as tibia; claws of female simple; propodeum with subhorizontal basal surface longer than metanotum, more than one-third to more than one-half as long as vertical surface of propodeum, no sharp line separating two surfaces; prestigma less than one-third as long as distance from base of stigma to vein r; stigma large, usually longer than but in some cases subequal to costal margin of marginal cell; marginal cell pointed at apex which is separated from wing margin by less than width of a vein; posterior margin of first submarginal cell nearly straight; first recurrent vein (absent from *incompleta*) entering first submarginal cell, second at or usually beyond apex of second submarginal cell; fovea of second tergum shallow and elongate, in some cases linear, in others quite broad.

The problem of hind tibial spurs in males of this genus is very interesting. The apex of the tibia is armed with several rather long bristles, like those of the tarsus, in all species, although they are especially noticeable in



FIGS. 356-366. Euryglossinae. 356. Side view of head of male of *Brachyhesma* (*Microhesma*) *incompleta*. 357. Outer surface of hind tibia of female of same. 358. Wings of same. 359. Dorsum of sixth tergum of same, female. 360-362. Male genitalia and eighth and seventh sterna of same. 363-365. Male genitalia and eighth and seventh sterna of *B. (Brachyhesma) sulphurella*. 366. Side view of head of male of same. The scale line represents 0.25 mm. and applies to all genitalia and sterna, not to other drawings.

incompleta. In *incompleta* there are no recognizable spurs, although the possibility exists that a spur is present but resembles a bristle. In *cooki* one exceedingly long and apically slender and curved spur or bristle, about as long as the tibia, arises well before the apex of the tibia. In *sulphurella* several slender curved hairs about three-fifths as long as the tibia arise from the same location, but a long spur or bristle, similar to that of *cooki* but less curved and longer than the tibia, arises from a more apical position on the tibia. Finally, in *dichaeta*, a very long bristle or spur arises from the location where such a structure exists in *cooki* and another from the location where such exists in *sulphurella*.

The apex of each penis valve of *incompleta* is produced downward as a very long, slender,

stylet-like process. Shorter slender projections extend apicad in *sulphurella*.

KEY TO THE SUBGENERA OF *Brachyhesma*

- Clypeus of male with lower half slightly curved under as seen in profile; fovea of second tergum of female less than six times as long as broad *Microhesma*
 Clypeus of male strongly bent under and produced posteriorly as concave plate in front of labrum and mandibles; fovea of second tergum of female linear . . . *Brachyhesma*, *sensu stricto*

MICROHESMA, NEW SUBGENUS

Plate 8, figures 12-14; text figures 356-362

TYPE: *Brachyhesma incompleta*, new species.

Clypeus of male largely exposed from front, not protuberant, lower portion gently

curved backward as seen in lateral view; scape of male (like that of female) much shorter than eye; lateral fovea of second metasomal sternum more or less linear in males, broader and four to six times as long as broad in females.

Brachyhesma incompleta is remarkable for the lack of the first recurrent vein in most specimens. *Brachyhesma hypoxantha* is the least extreme member of the genus in its generic characters, for the clypeus of the female is only somewhat more than four times as broad as long (more than five times in all other species), and the antennal bases are only about three times as far from the anterior ocellus as from the clypeal margin (more than five times as far in other species).

DISTRIBUTION: New South Wales, southern Queensland, and Western Australia.

INCLUDED SPECIES

- Brachyhesma* (*Microhesma*) *cooki* Michener, new species (U.S.N.M.)
dichaeta Michener, new species (W.A.M.)
hypoxantha (Rayment, 1934) (*Euryglossina*) n. comb. (C.S.I.R.O.)
incompleta Michener, new species (Q.M.)

BRACHYHESMA, NEW SUBGENUS

Plate 8, figure 11; text figures 363-366

TYPE: *Euryglossina sulphurella* Cockerell, 1913.

Clypeus of male, as seen in front, a mere rim across lower end of face, but flexed under to form a large triangular plate, exposed ventrally, in front of labrum and mandibles; clypeus and lower part of frons strongly protuberant (forward) in male; scape of male nearly as long as eye; lateral fovea of second metasomal tergum linear, in female a long black streak not or scarcely depressed.

DISTRIBUTION: Australia, north to central Queensland.

INCLUDED SPECIES

- Brachyhesma* (*Brachyhesma*) *colorata* (Rayment, 1935) (*Euryglossina*) n. comb. (C.S.I.R.O.)
microxantha (Cockerell, 1914e) (*Euryglossina*) n. comb. (B.M.)
perlutea (Cockerell, 1916b) (*Euryglossina*) n. comb. (B.M.)
sulphurella (Cockerell, 1913e) (*Euryglossina*) n. comb. (B.M.)

SUBFAMILY HYLAEINAE

The bees of this subfamily share with the Euryglossinae and most neotropical Chilicolinae the lack of a pollen-collecting scopa in the female. The pollen that is used in provisioning the cells is transported in the crop of the mother bee instead of on scopal hairs. Associated with this means of pollen carrying are the general sparsity and shortness of hairs of the Hylaeinae.

Distinctive features of the tribe include the lack or near lack of basitibial plates, lack of the pygidial plate (except in a few species of *Hylaeus* and *Hyleoides* in which it is broad and defined by carinae, not slender and almost spinelike as in the Euryglossinae), and lack of a longitudinal furrow in the middle of the anterior face of the first metasomal tergum (a groove in this position exists in *Hylaeus douglasi*). The majority of species of the subfamily can be recognized by the rather elongate face, usually with yellow markings, with the clypeus extending high up so that the tentorial pits are often at or below the middles of the lateral portions of the epistomal suture. Particularly in Australia, however, this character fails in some species, notably broad heads being characteristic of a few species such as *Hylaeus simplex*.

As often happens in a group in which extinction does not seem to have eliminated many major lines, one finds a large and diversified group (in this case *Hylaeus*) with which are associated a number of less or more divergent elements. Some of these are not very divergent and have been accorded only subgeneric rank or not even that. Others are more divergent and have been given generic status.

The central diversified group within the genus *Hylaeus* is the Australian subgenus *Prosopisteron*. All the Australian genera and subgenera could have arisen directly from *Prosopisteron* except for (1) *Hyleoides* which is so different that its relationship is not clear, (2) *Palaeorhiza* which may have arisen from *Hylaeorhiza* which in turn came from *Prosopisteron*, (3) *Xenohylaeus* which may have arisen from *Pseudhylaeus*, and (4) *Gnathoprosopis*, *Gnathoprosopoides*, and *Sphaerhylaeus* which may have arisen from a common stem rather than independently from *Prosopisteron*.

It is by no means certain that the right groups have been given generic rank. *Hylaeorhiza* and *Hylaeopsis* are rather similar to some large species of *Prosopistemon* and could have been included as subgenera of *Hylaeus*. On the other hand *Macrohylaeus* and especially *Meghylaeus* seem very distinct and perhaps could be given generic status.

It is certain that the Hylaeinae are more diversified and constitute a more important part of the bee fauna in Australia than in any other part of the world. Although the African *Nothylaeus* possibly warrants generic rank, probably in a conservative classification such as is here presented, all the Hylaeinae of the world would fall in a single genus, *Hylaeus*, except for the other genera of the Australian Region. Even among forms here left in *Hylaeus* there seems to be more diversity than is found among the species of *Hylaeus* of all the rest of the world. The related neotropical subfamily Chilicolinae is quite different, and these comments should not be construed to include it.

In the generic and subgeneric descriptions relating to the Hylaeinae, notes on many significant characters have been omitted to save space. It can be assumed for any group, if no contrary statement is made, that the following statements apply: glossa of male short, subtruncate, like that of female; face without deep depressions like those of males of *Meroglossa*; scape slender; paraocular ridges or carinae absent or inconspicuous; preoccipital carina absent; wings hairy throughout; stigma broad, not parallel sided, much longer than prestigma; anterior face of mesepisternum rounding onto lateral face, with no carina or sharp angle intervening; first tergum without longitudinal median groove (except for longitudinal depression at extreme base); tibiae and body without unusual spines or projections.

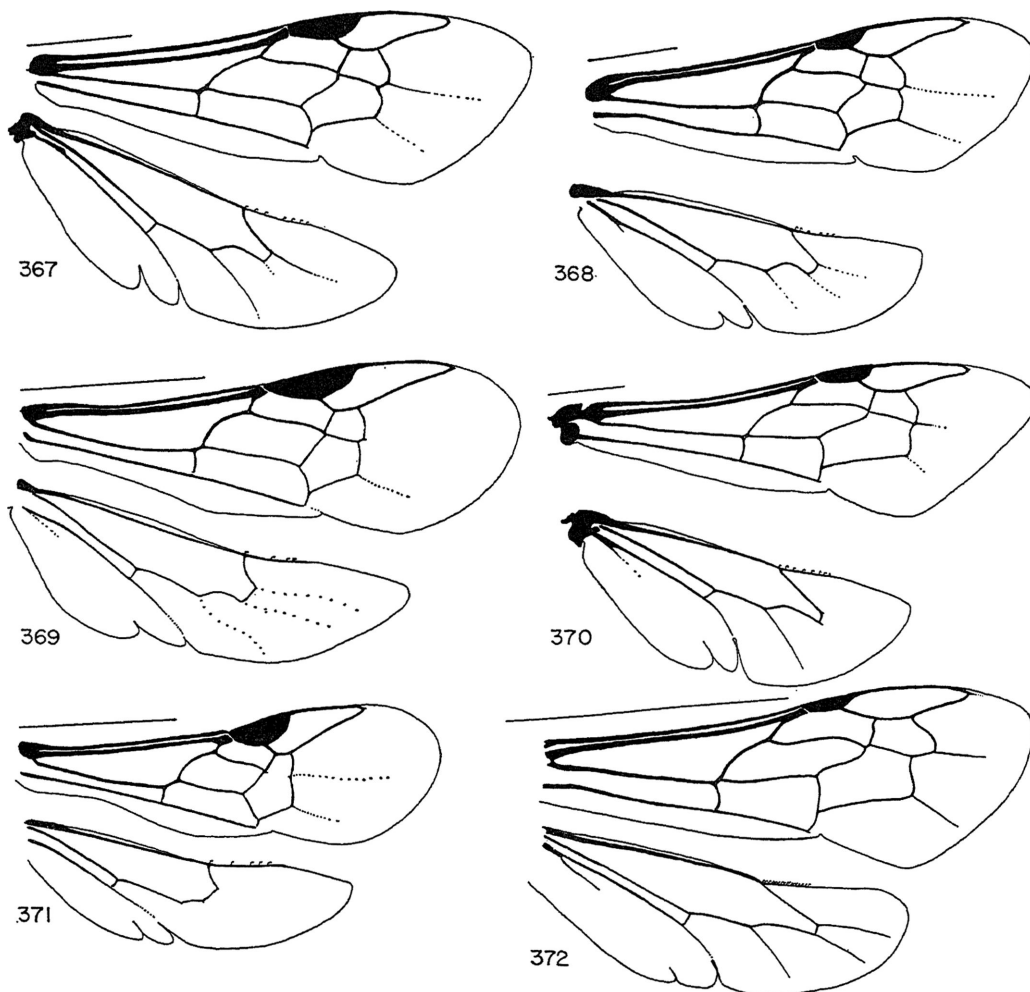
Several characters that are often thought of as basic in apoid classification vary within and among genera of the Hylaeinae. Basitibial plates are ordinarily absent from the Hylaeinae but are present as elevated, shining areas, defined along their posterior margins, in females of *Hyleoides* (weak), *Anastoroides*, *Hylaeorhiza burnsi*, and *Amphylaeus nubilosellus*. The pygidial plate of the female is absent except in some species of

Hyleoides and some species of two subgenera of *Hylaeus*. The inner hind tibial spurs are finely ciliate except in some *Palaeorhiza* and some *Meroglossa*.

The species of this subfamily were not treated in Cockerell's series entitled "The bees of Australia," but he did give several keys to species of which the following are the most important: a key to the species of *Hyleoides* (Cockerell, 1909a), a key to New Zealand *Hylaeus* (Cockerell, 1909a), and a key to Australian *Hylaeus* (Cockerell, 1910f).

KEY TO THE GENERA OF THE HYLAEINAE

1. Spine of anterior tibia prolonged into long curved process, at least as long as basitarsal diameter; stigma with edge within marginal cell straight; posterior margin of first tergum angulate forward above level of second tergal spiracle, at apex of lateral carina; apex of first sternum transverse. *Hyleoides*
Spine of anterior tibia small or absent; stigma with edge within marginal cell usually convex; posterior margin of first tergum straight to the broadly rounded posterior lateral angle; apex of first sternum with median cleft or slit 2
2. Second submarginal and second median cells of forewing confluent; minute slender bees with first tergum, at least in male, much longer than broad seen from above . . . 3
Second submarginal and second median cells of forewing separated as in other bees; size and form variable, rarely as slender, or with as slender a first tergum, as in above 4
3. Mesepisternum broadly attaining propodeum below; preoccipital carina present; facial fovea of female very short, not attaining summits of eyes (East Indies)
. *Gephyrohylaeus*
Mesepisternum separated from propodeum by metepisternum; preoccipital carina absent; facial fovea of female a long groove attaining summit of eye as in *Hylaeus*
. *Heterapoides*
4. Outer apical margin of hind tibia with one or two spines on outer surface behind base of outer tibial spur; gradulus of second tergum recurved and usually exposed. (Glossa of male pointed; face of male with pair of broad, deep depressions usually extending from level of tentorial pits or below to well above antennal bases.) *Meroglossa*
Apex of hind tibia without spines, except for the female of *Amphylaeus* which has small spines but has gradulus of second tergum



FIGS. 367-372. Wings of Hylaeinae. 367. *Hylaeus (Prosopistemon) melanops*. 368. *H. (Pseudhylaeus) albocuneatus*. 369. *H. (Edriohylaeus) ofarrelli*. 370. *H. (Euprosopis) elegans*. 371. *Heterapoides extensa*. 372. *Hylaeus (Macrohylaeus) alcyoneus*. The scale lines represent 1 mm. except on *H. alcyoneus* where the line represents 5 mm.

- transverse, procurved medially 5
5. Basal vein interstitial with cu-v or nearly so; second recurrent vein beyond second transverse cubital; metasoma of male (female unknown) with first three terga enormous, others telescoped inside; gradulus of second tergum absent, faintly indicated laterally, pregradular area densely hairy, especially laterodorsally. (Preoccipital carina present.) *Pharohylaeus*
- Basal vein distal to cu-v; second recurrent often interstitial with or basal to (although in some cases beyond) second transverse cubital; metasoma not as above; gradulus of second tergum present, pregradular area not

- densely hairy or such area not exposed. . . 6
6. Preoccipital carina present or at least indicated medially 7
- Preoccipital carina absent. 8
7. Triangular area of propodeum almost all dorsal, only one-fourth of its length or less on posterior, vertical surface (about one-third in *hamada*); usually brilliantly metallic species or with extensive yellow markings on genal areas and thorax; glossa of male pointed. *Palaeorhiza*
- Triangular area of propodeum more than one-fourth on vertical surface; black or dull metallic blue species without yellow on genal areas and with the yellow on thorax

- usually limited to pronotal margin and posterior lobes; glossa of male obtuse, as in female *Hylaeus* (part)
8. Lateral fovea of second tergum sublinear, horizontal¹; glossa of male pointed . . . 9
Lateral fovea of second tergum absent, punctiform, or broadly oval or rounded; glossa of male usually truncate or bilobed like that of female, in *Hylaeorhiza* with small median point 10
9. Apex of first tergum and base of second strongly constricted; genal area and thorax with yellow maculations; glossa of male rather long and slender, about one-fourth as long as head; subantennal sutures of both sexes arcuate inward *Hemirhiza*
Metasoma not constricted; genal area black, thorax with yellow limited to pronotal lobes, scutellum, and metanotum; glossa of male broad and short; subantennal sutures of male arcuate outward *Amphylaeus*
10. Metasoma with velvety pubescence forming broad apical orange bands across second, fourth, and (to a lesser degree) fifth terga; appearance like that of *Hyleoides concinnus* *Anastoroides*
Metasoma with pubescence sparse, not forming broad apical bands, not orange . . . 11
11. Propodeal triangle virtually smooth, anterior part sloping steeply and curving onto vertical part without interruption so that there is no subhorizontal basal zone (fig. 466); glossa of male with small median point apically; outer apical margin of hind tibia, especially of female, with obtuse angle (fig. 473) made noticeable by a concavity *Hylaeorhiza*
Propodeal triangle rarely largely horizontal or undefined, usually with subhorizontal basal zone, in some cases very broad and undefined, in others well defined, often narrow, not steeply sloping and continuous with vertical surface; glossa of male not pointed; outer apical margin of hind tibia straight or curved, or slightly angulate, the angle not set off by concavity *Hylaeus*

HYLAEINAE (MOSTLY *Hylaeus*) NOT PLACED
IN THE PRESENT CLASSIFICATION

callosa Cockerell, 1910i (*Prosopis*) (desc. Berlin)
cyaniventris Friese, 1924 (*Prosopis*) (desc.)
grandis Friese, 1924 (*Prosopis*) (desc.)
indicator Cockerell, 1910i (*Prosopis*) (desc. Berlin)
liogonius Vachal, 1899 (*Prosopis*) (desc.)
melaleuca Rayment, 1953a (*Hylaeus*) (desc.)
obscuriceps Friese, 1924 (*Prosopis*) (desc.)

¹ In the subgenus *Euprosopella* of *Hylaeus* the fovea is horizontally elongate and almost sublinear.

GENUS *HYLAEUS* FABRICIUS

Plate 8, figures 15–21; plate 9; plate 10,
figures 1–11; text figures 367–370, 372,
373, 382–455, 459

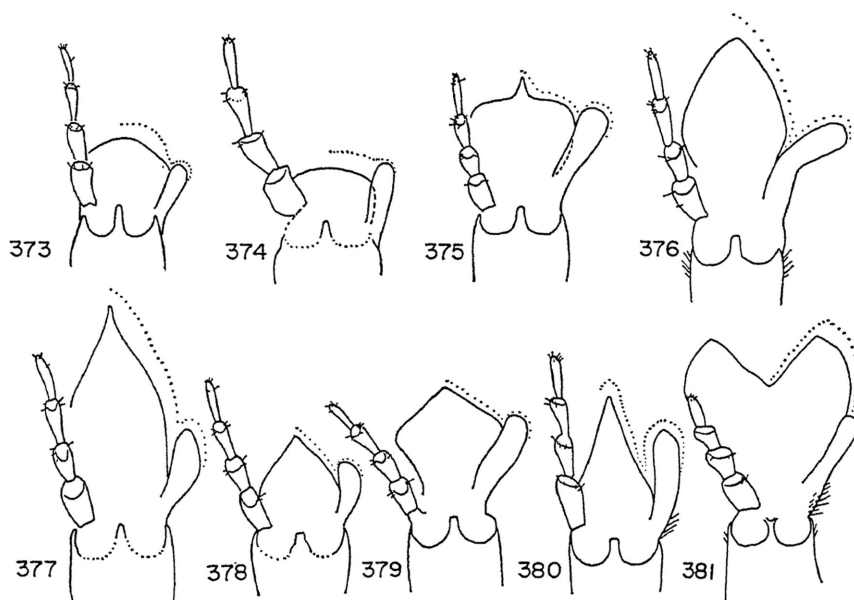
Hylaeus FABRICIUS, 1793, p. 302. Type: *Apis annulata* Linnaeus, 1758 (designation of Latreille, 1810, p. 438).

This is a worldwide genus of usually small bees, usually with limited pale integumental markings on the head and thorax. In most parts of the world there is relatively little diversity in aspect among the species of the genus, and they constitute a rather small percentage of the total bee fauna. In Australia, however, *Hylaeus* is one of the major genera, and there is great diversity in aspect as well as in structure. Of the various subgenera known in other parts of the world none reaches Australia, although *Prosopistemon* and *Pseudhylaeus* exhibit evidence of relationships with northern subgenera. The subgenus *Nesoprosopis* of the Palearctic Region, which has developed a swarm of species in Hawaii, has no representatives in the South Pacific. One subgenus, *Prosopistemon*, occurs in New Zealand as well as Australia.

The genus *Hylaeus* has, at various times in the past, been known under the generic name *Prosopis*. The name *Hylaeus*, which has priority, has also been long and widely used; a proposal to suspend the rule of priority and place *Prosopis* on the list of *nomina conservanda* was not accepted (see Opinion 170, International Commission on Zoological Nomenclature). *Prosopis* is, however, the valid name of a holarctic subgenus of *Hylaeus* (see Popov, 1939, and Michener, 1944).

A key to Australian species of the genus was given by Cockerell (1910f), and a key to the New Zealand species was given by the same author (1909a).

Mandibles of female bidentate to tridentate, rarely quadridentate; preoccipital carina present or absent. Stigma of moderate size to large, slender and approaching parallel-sided condition only in one or two species of the subgenus *Euprosopoides* and in the subgenus *Meghylaeus*; marginal cell with free part usually longer than rest; second submarginal cell two-thirds as long as first or less; ridge in front of mesocoxa weak or absent.



FIGS. 373-381. Apex of prementum, glossa, paraglossa (right), and labial palpus (left) of males of Hylaeinae. Dotted lines represent ends of hairs on glossa and paraglossa. 373. *Hylaeus* (*Xenohylaeus*) *rieki*. 374. *Pharohylaeus lactiferus*. 375. *Hylaeorhiza nubilosa*. 376. *Hemirhiza melliceps*. 377. *Palaeorhiza* (*Palaeorhiza*) *reginarum*. 378. *Amphylaeus* (*Agogenohylaeus*) *nubilosellus*. 379. *A.* (*Amphylaeus*) *morosus*. 380. *Meroglossa canaliculata*. 381. *Hyleoides concinnus*.

The malar space is very short, except where greater length is indicated in the following subgeneric descriptions.

The species of *Hylaeus* make cells of a transparent cellophane-like membrane in burrows in stalks, twigs, or reeds, in pre-existing cavities such as beetle burrows in old wood, or (at least in some parts of the world) in the ground. In Australia nests of the subgenera *Prosopistemon* (Rayment, 1931a, 1935, 1953a), *Edriohylaeus* (Appendix 2), and *Euprosopis* (Rayment, 1935) have been described. Myers (1935) records masses of *H.* (*Euprosopis*) *rollei*, possibly preparing to hibernate together under the bark of a small dead limb.

KEY TO THE AUSTRALIAN SUBGENERA OF *Hylaeus*

1. Middorsal margin of pronotum well below level of dorsal surface of scutum; dorsolateral angles of pronotum mere inconspicuous convexities 2
- Middorsal margin of pronotum reaching level of dorsal surface of scutum or nearly so;

distinct dorsolateral pronotal angles intervening between middorsal part of pronotal margin and pronotal lobes 3

2. Large metallic blue species; stigma parallel sided; free part of marginal cell about as long as remainder; second submarginal cell more than two-thirds as long as first. . . .

. *Macrohylaeus*

Moderate sized, nonmetallic; stigma not parallel sided; free part of marginal cell much longer than remainder; second submarginal cell little if any more than half as long as first *Hylaeteron*

3. Preoccipital carina present 4
- Preoccipital carina absent. 6

4. Second submarginal cell more than two-thirds as long as first; mandible broadest basally and tapering, inner apical tooth small . . .

. *Sphaerohylaeus*

Second submarginal cell half as long as first or less, mandible broad, not much tapering, inner apical tooth enormously expanded (figs. 439-441), often broadly truncate . . 5

5. Dorsal surface of propodeum areolate, separated by sharp, irregular carina from posterior surface; eighth sternum of male with

- lateral shoulders produced posteriorly; seventh sternum of male with one pair of apical lobes *Gnathoprosopis*
- Propodeum not areolate, dorsal surface curving onto posterior one; eighth sternum of male with lateral shoulders not produced posteriorly; seventh sternum of male with two pairs of apical lobes *Gnathoprosopoides*
6. Prestigma almost as long as stigma from base to vein r; stigma parallel sided; wings almost bare; length of body more than 15 mm. *Meghylaenus*
- Prestigma not more than two-thirds as long as stigma from base to vein r; stigma broader and not parallel sided (nearly so in some *Euprosopoides*); wings usually hairy; length of body 12 mm. or less 7
7. Propodeal triangle not or scarcely defined but virtually all on dorsal, horizontal surface, as can be judged by high level of propodeal pit; first metasomal tergum of male slightly more than 1.5 times as long as broad seen from above; seventh sternum of male with two apically directed lobes with broad bases *Edrioehylaenus*
- Propodeal triangle more or less distinct and with at least one-fourth of its length on posterior, vertical surface; first tergum less than 1.5 times as long as broad, commonly broader than long, as seen from above; seventh sternum of male with two or four laterally directed lobes with narrow bases 8
8. Anterior surface of mesepisternum set off, at least below, from rest of episternum by a distinct angle and different sculpturing. (Propodeal triangle finely roughened and dull, without sharp line separating dorsal from posterior surfaces, often with ridges and in some cases areolate; metasoma partly or wholly red) . . . *Rhodohylaenus*
- Anterior face of mesepisternum curving onto lateral face with no sharp distinction . . . 9
9. Propodeal triangle with narrow horizontal pitted or longitudinally carinate basal zone separated by a transverse carina (in some cases present only medially) or in *Euprosopella* only by abrupt termination of pitted zone, from rest of triangle, which may continue horizontally or become abruptly declivous; claws usually with inner prong arising medially or a little beyond middle of claw, and diverging sufficiently that distance between apices of prongs is greater than median width of claw; second submarginal cell usually two-thirds as long as first. 10
- Propodeal triangle without narrow pitted or carinate basal zone; claws usually with inner prong arising subapically and subparallel to other prong so that distance between their apices is less than median width of claw; second submarginal cell less than two-thirds as long as first 12
10. A deep constriction between the rather bulbous first two terga, as seen in profile; propodeum with one-third or more of length of triangle horizontal, rounding onto vertical surface, a narrow row of pits at extreme base; seventh sternum of male with two rather small apical lobes. (Malar space about half as long as mandibular width.) *Euprosopella*
- No metasomal constriction; propodeum usually with a carina (in some cases medially only) separating narrow horizontal zone from vertical surface; seventh sternum of male with four lobes 11
11. Malar space more than half as long as mandibular width; seventh sternum of male with distal pair of lobes slender and curved outward; eighth sternum simple at apex *Euprosopis*
- Malar space less than half as long as mandibular width; seventh sternum with apical lobes broad, one above the other on each side; eighth sternum ending in slender process with two large, black, hairy, apical lobes *Euprosopoides*
12. Apical parts of terga (at least second and third terga) with short whitish hair directed laterally; clypeus usually very flat and usually finely longitudinally striate; outer margins of anterior apical lobes of seventh sternum of male with coarse setae or "pectinate" 13
- Apical parts of terga with hair directed posteriorly, like that of rest of metasoma; clypeus usually not so flat, not longitudinally striate; margins of lobes of seventh sternum of male often setose but not coarsely pectinate like those of *Pseudhylaenus*. . . *Prosopistemon*
13. Clypeus of female with very fine, longitudinal, median carina; male with broad deep excavation on each side of face extending from clypeus to above antennae; scape of male broad and flat; margins of terga dark *Xenohylaenus*
- Clypeus of female not carinate; male without facial concavities or only weak ones above antennae; scape of male, if enlarged, not flat; margins of terga broadly pallid translucent, at least laterally . . . *Pseudhylaenus*

SUBGENUS PROSOPISTERON COCKERELL

Plate 8, figures 15-19; text figures 367,
382-395, 433, 434, 437, 438

Prosopisteron COCKERELL, 1906e, p. 17. Type:
Prosopisteron serotinellum Cockerell, 1906 (monobasic).

The name *Prosopisteron* is here used for a large and diversified group of species, although it has hitherto been applied to only one or two of them. As indicated in the discussion of the genus, *Prosopisteron* closely approaches *Gnathoprosopoides* and even *Sphaerhylaesus* in many features. It contains diversified elements which may be segregated later. Nonetheless, all its species agree in the broad apical lobes of the seventh sternum of the male. At first these are suggestive of those of the Palearctic subgenus *Koptogaster* (*Pseudobranchiata* Méhely), but in that group the lobes are hairless, while they are hairy in *Prosopisteron*. Variation in the shape of these lobes, such as is shown by Méhely (1935) for two species of *Koptogaster*, occurs also in *Gnathoprosopoides* and in *Prosopisteron*, and in the latter subgenus one pair of lobes is in some cases much reduced. *Prosopisteron* also differs from *Koptogaster* by its usually much finer punctation, smoother propodeum, shorter second submarginal cell, not or little depressed tergal margins, and the normal rather than very strong tergal graduli.

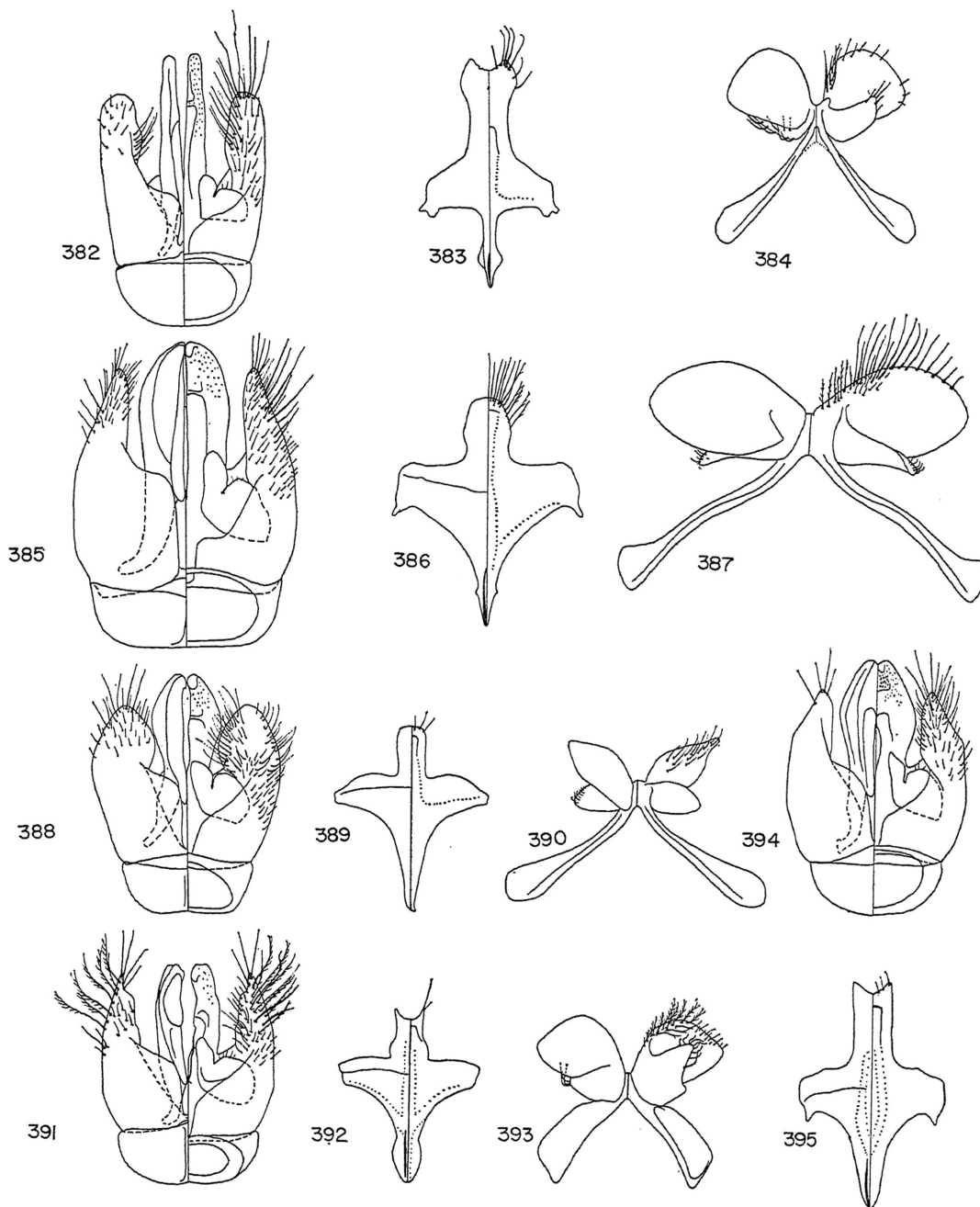
Mandibles only rarely with weak third or fourth tooth in female; interantennal distance greater than clypeo-ocular distance; subantennal sutures shorter than to two times as long as diameter of antennal socket; middle segments of male flagellum less than twice as long as broad (except in *agilis* from New Zealand). Claws with prongs usually parallel (divergent in such forms as *cyaneomicans*, *cyanophilus*, *basilautus*); stigma large, two-thirds to three-fourths as long as, or nearly as long as, costal margin of marginal cell (in *semipersonatus* little more than half as long); free part of marginal cell longer, usually twice as long, as rest; apex of cell usually very near wing margin; distance from apex of cell to wing tip equal to or less than length of free part of cell; second submarginal cell half as long as first or less (more than half in a few species such as *douglasi*, *basilautus*, *melanops*, and *cyaneomicans*, two-

thirds in *cyanophilus*), receiving both recurrent veins or the first received near end of first submarginal cell; propodeum with horizontal area shorter than vertical, triangle with one-fourth to one-half (more than two-thirds in *basilautus*) of its length on vertical surface; horizontal surface rounded onto vertical surface, dull but not areolate or carinate (except in *cyanophilus*) and without carina or sharp angle separating dorsal from horizontal surfaces (except *semicastaneus*, see below; also *bandinensis*, *cyanomicans*, and *nigrescens* have triangle coarsely transversely striate). Second tergum with fovea absent or punctiform (larger and round or oval in *basilautus*, *melanops*, *serotinellus*, *crassior*, *primulipictus*, and the group of *bidentatus* and *marionellus*; gradulus of second tergum transverse (weakly procurved medially in *basilautus*, weakly recurved in *auriferus* and *xanthopsycha*); seventh sternum of male with four apical lobes, at least one pair of them broad and with hairs; eighth sternum with median process usually notched at apex, in some cases bifid or simple.

This subgenus contains a large number of small species of generally rather uniform appearance. These small species probably do not constitute a natural group, since among them are forms with rather different male hidden sterna. For example, in *eugeniellus*, which approaches *Heterapoides* in some characters, the seventh sternum has one of the pairs of lobes greatly reduced, while in other species both are large. *Hylaesus albozebratus* is remarkable for its abundant white maculations.

Another group contains generally larger species, many of them with peculiar features of one sort or another, some of which are listed in the description above and others below: *Hylaesus semipersonatus* is unusual for the small stigma (see description above), the rather long malar space of the male (half as long as basal width of mandible), and the presence of a depression on each side of the face, principally above the level of the antennae (genitalia not examined).

Hylaesus melanops (with *crassior*) is unusual for the presence of a distinct pygidial plate in the female, a character also found in some species of the subgenus *Euprosopoides* and of the genus *Hyleoides*. As the male is



FIGS. 382-395. Hylaeinae. 382-384. Male genitalia and eighth and seventh sterna of *Hylaeus* (*Prosopistemon*) *serotinellus*. 385-387. Same of *H. (P.) douglasi*. 388-390. Same of *H. (P.) perhumilis*. 391-393. Same of *H. (P.) tuamotuensis*. 394, 395. Male genitalia and eighth sternum of *H. (P.) albozebratus*.

unknown, placement in *Prosopistemon* is provisional. *Hylaeus melanops* is also unusual in possessing paraocular carinae.

Hylaeus flavojugatus and *crassifemoratus* have an apparently turgid pronotum like that of many species of the subgenus *Gnathoprosopis*.

The species from New Zealand clearly fall in *Prosopistemon*. *Hylaeus agilis* is unusual for the long antennae of the male, the middle flagellar segments being more than twice as long as broad. Most of the New Zealand species have broader genal areas than most *Hylaeus*.

Hylaeus blanchae (known to me only from the female type) is most unusual in having a large, quadrate head with large mandibles. The second recurrent vein is well beyond the first transverse cubital; the maxillary palpi are very long; the pre-episternal groove is in a large depression sloping anteriorly, and the second to fourth metasomal terga have apical fasciae of white hair laterally. Discovery of the male may show this to be a distinct genus or subgenus.

Hylaeus douglasi and *H. simplex* are unusual in the genus in having robust bodies, suggestive in form of females of the subgenus *Euryglossa* (Euryglossinae). The subgenus *Macrohylaeus* is also heavy bodied, but these species of *Prosopistemon* are even more robust relative to their size. *Hylaeus douglasi* is unusual in having long simple mandibles in the female (male unknown).

Hylaeus turgicollaris is a rather large species remarkable for the much swollen, apparently turgid dorsolateral parts of the pronotum. The male is unknown.

Hylaeus frederici is an unusually large species with the lobes of the seventh sternum of the male peculiar in that they do not overlap basally, one being distal to the other, although at their apices the lobes overlap. The apparently related *elongatus*, however, has a seventh sternum quite ordinary for the group. The largest of all the species is *H. basilaetus*. Being unusual in size and in certain features indicated in the above subgeneric description, and known only from the female, its position remains in some doubt.

Hylaeus cyanophilus perhaps should be separated subgenerically, for the horizontal

surface of the propodeum is coarsely reticulate areolate, the second submarginal cell is two-thirds as long as the first, and the malar area is half as long as the mandibular width. It could be the sort of insect from which the subgenus *Euprosopis* was derived, as is suggested not only by the propodeum, malar areas, and venation, but by the distal lobes of the seventh sternum of the male which, while broad basally, are attenuate and minutely spatulate apically. Unfortunately I have seen only the male holotype of *cyanophilus*; further material may suggest that it be transferred to *Euprosopis* or to a new intermediate subgenus.

The species *bidentatus*, *marionellus*, *hobartianus*, *quadriceps*, *auriferus*, and *striatus* may constitute a natural group, although those known to me only as females (*quadriceps*, *striatus*, and *auriferus*) are included only tentatively. These forms approach *Gnathoprosopides*. Although they lack the broad mandibles and the preoccipital carina characteristic of that subgenus, they have the two large tubercles of the third sternum of the male and the shining mesosternal elevation mesal to each subplural signum, as in group *a* of *Gnathoprosopides*. *Hylaeus douglasi*, a quite different, very robust species, also has protuberances on the third sternum. *Hylaeus distractus* has possibly homologous mesosternal prominences, although they are more rounded and more posterior in position, but has only a transverse, arcuate ridge on the third sternum, like that of *cyaneomicans* and *nigrescens*. *Hylaeus greavesi* seems, by its appearance and color pattern, to be related to the small species of *Prosopistemon*, but the male has two large tubercles on the third sternum (in addition to a median one); it lacks mesosternal prominences. *Hylaeus striatus*, known only in the female, is interesting in that its rather broad mandibles are quadridentate, there being one tooth below and two teeth above the principal apical tooth.

DISTRIBUTION: Chatham Islands; New Zealand; Tasmania; Australia north to northern Queensland and Darwin; New Guinea; Tuamotu Islands.

The record for the Chatham Islands is for a New Zealand species, *H. agilis* (Alfken, 1904). A single species occurs in the Tuamotu Archipelago. This is most remarkable in

view of the apparent absence of the genus from the islands other than New Zealand and the Chatham Islands farther west in the Pacific.

INCLUDED SPECIES

- Hylaeus* (*Prosopistemon*) *accipitrus* (Cockerell, 1914g) (*Prosopis*) (B.M.)
agilis (Smith, 1876) (*Prosopis*) (B.M.) New Zealand
albozebratus Michener, new species (W.A.M.)
amatulus (Cockerell, 1922a) (*Prosopis*) (Q.M.)
aralis (Cockerell, 1916e) (*Prosopis*) (B.M.)
asperithorax (Rayment, 1927a) (*Euryglossa*) (U.S.N.M.)
auriferus (Cockerell, 1918b) (*Prosopis*) (Q.M.)
basilautus (Rayment, 1954a) (*Meroglossa*) n. comb. (C.S.I.R.O.)
baudiniensis (Cockerell, 1905e) (*Prosopis*) (B.M.)
bicoloratus (Smith, 1853) (*Prosopis*) (B.M.)
bicuneatus (Cockerell, 1910d) (*Prosopis*) (B.M.)
bidentatus (Smith, 1853) (*Prosopis*) n. comb.
blanchae Rayment, 1953b (C.S.I.R.O.)
brevior (Cockerell, 1918a) (*Prosopis*) (U.S.N.M.)
cameroni (Cockerell, 1905j) (*Prosopis*) = *sulcifrons* Cameron, 1898, not Smith, 1853 (B.M.) New Zealand
capitosus (Smith, 1876) (*Prosopis*) (B.M.) New Zealand
centralis (Friese, 1924) (*Prosopis*) ("typus" A.M.N.H.)
chlorosomus (Cockerell, 1913a) (*Prosopis*) (U.S.N.M.)
cliffordiellus Rayment, 1953a (C.S.I.R.O.)
crassifemoratus (Cockerell, 1922a) (*Prosopis*) (Q.M.)
crassior Cockerell, 1926a (N.M.V.)
cyaneomicans (Cockerell, 1910d) (*Prosopis*) (B.M.)
cyanophilus (Cockerell, 1910c) (*Prosopis*) (B.M.)
distractus (Cockerell, 1914g) (*Prosopis*) (B.M.)
douglasi Michener, new species (W.A.M.)
elongatus (Smith, 1879) (*Prosopis*) (B.M.)
eugeniellus (Cockerell, 1910c) (*Prosopis*) (B.M.)
flavojugatus (Cockerell, 1912a) (*Prosopis*) (C.S.I.R.O.)
frederici (Cockerell, 1905j) (*Prosopis*) = *similis* Smith, 1853, not Fabricius, 1793 (B.M.)
greavesi (Rayment, 1935) (*Gnathoprosopis*) n. comb. (C.S.I.R.O.)
hobartiellus Cockerell, 1929d (Q.M.)
hobartianus (Cockerell, 1905e) (*Prosopis*) (B.M.)
hudsoni (Cockerell, 1925a) (B.M.) New Zealand
infans (Cockerell, 1910c) (*Prosopis*) (B.M.)
innocens (Cameron, 1898) (*Prosopis*) (B.M.) New Zealand
laevigatulus Michener, new name for *Prosopis laevigata* Smith, 1854, Catalogue of hymenopterous insects in the collection of the British Museum, vol. 2, p. 420, not *P. laevigata* Eversmann, 1852 (cotype B.M.). New Zealand. *P. levigata* Dalla Torre, 1896, is an unnecessary emendation
leai (Cockerell, 1912d) (*Prosopis*) (U.S.N.M.)
littleri (Cockerell, 1918a) (*Prosopis*) (B.M.)
mackayensis (Friese, 1924) (*Prosopis*) (B.M.)
maorianus (Cockerell, 1909a) (*Prosopis*) (desc.) New Zealand
marionellus (Rayment, 1931a) (*Gnathoprosopis*) n. comb. (C.S.I.R.O.)
mediavirens (Cockerell, 1913a) (*Prosopis*) (U.S.N.M.)
melanops (Cockerell, 1916d) (*Prosopis*) (U.S.N.M.)
microphenax (Cockerell, 1910c) (*Prosopis*) (B.M.)
murrayensis Rayment, 1935 (C.S.I.R.O.)
nanus (Friese, 1924) (*Prosopis*) (desc.)
nigrescens (Cockerell, 1918b) (*Prosopis*) (Q.M.)
perhumilis (Cockerell, 1914g) (*Prosopis*) (B.M.)
perpictus Rayment, 1935 (C.S.I.R.O.)
pictulus Michener, new name for *Hylaeus pictus* Rayment, 1935, A cluster of bees, p. 655, not *Prosopis picta* Smith, 1853 (C.S.I.R.O.)
primulipictus (Cockerell, 1905e) (*Prosopis*) (B.M.)
quadratus (Smith, 1853) (*Prosopis*)
quadriceps (Smith, 1879) (*Prosopis*) (B.M.)
relegatus (Smith, 1876) (*Prosopis*) (B.M.) New Zealand
sanguinipictus (Cockerell, 1914g) (*Prosopis*) (B.M.)
scintillans (Cockerell, 1922a) (*Prosopis*) (Q.M.)
scintilliformis (Cockerell, 1913a) (*Prosopis*) (U.S.N.M.)
scintillus (Cockerell, 1912a) (*Prosopis*) (B.M.)
semipersonatus Cockerell, 1929d (Q.M.)
serotinellus (Cockerell, 1906e) (*Prosopistemon*) (B.M.)
simplex Michener, new species (W.A.M.)
striatus (Rayment, 1935) (*Gnathoprosopis*) n. comb. (C.S.I.R.O.)
subcoronatus Rayment, 1935 (cotype, N.M.V.)
trilobata (Cockerell, 1910i) (*Prosopis*) (Berlin*)
trimerops (Cockerell, 1916e) (*Prosopis*) (B.M.)
tuamotuensis Michener, new species (Bishop) Tuamotu Archipelago
turgicollaris Michener, new name for *Meroglossa xanthocollaris* Rayment, 1954a, Australian Zool., vol. 12, p. 52, not *Gnathoprosopis xanthocollaris* Rayment, 1935, which is a *Hylaeus* (C.S.I.R.O.)
turneri (Friese, 1924) (*Prosopis*) (desc.)

- vittatifrons* (Cockerell, 1913a) (*Prosopis*) (U.S.N.M.)
vittipennis (Friese, 1924) (*Prosopis*) (desc.)
 = *Prosopis maculipennis* Friese, 1924, not Smith, 1879 (desc.)
wilsoni (Rayment, 1928a) (*Euryglossa*) (Wilson)
woyensis Rayment, 1939 (C.S.I.R.O.)
wynyardensis Cockerell, 1929d (Q.M.)
xanthaspis (Cockerell, 1910d) (*Prosopis*) (B.M.)
xanthognathus Rayment, 1935 (C.S.I.R.O.)
xanthopsycha (Cockerell, 1922a) (*Prosopis*) (Q.M.)

EDRIOHYLAEUS, NEW SUBGENUS

Plate 8, figures 20, 21; text figures 369, 396-398, 459

TYPE: *Hylaeus ofarrelli*, new species.

This subgenus contains a species, the male of which is nearly as slender and delicate as that of species of the genera *Heterapoides* and *Gephyrohylaeus*. *Edriohylaeus* differs from those genera in the somewhat heavier body form, especially of the female, as indicated in the description of the propodeum and metasoma below, in the complete separation of the second submarginal and second median cells (as in other *Hylaeus*), and in the unusual seventh sternum of the male. From other subgenera of *Hylaeus*, *Edriohylaeus* differs in the almost wholly dorsal propodeal triangle, in the slender metasoma of the male, the peculiar seventh sternum of the male, and other characters. The subgenus may be a derivative of *Prosepisteron* which derived its slender body form and propodeal structure independently from those of the similar but more extreme *Heterapoides*; on the other hand it may have arisen from an ancestor of *Heterapoides* that had already acquired the slender body form and the propodeal structure of that group but that had not yet developed the venational reduction of that group nor the seventh sternal peculiarities of *Edriohylaeus*. The seventh sternum of the male is quite unlike that of any other known hylaeine bee.

Mandible of the usual form, tapering to bidentate apex; antenna of male long, middle flagellar segments more than 1.5 times as long as broad; interantennal distance greater than clypeo-ocular distance which is, however, considerable; subantennal sutures of both sexes considerably longer than diameter of antennal socket. Prongs of claws sub-

parallel; stigma large, virtually as long as costal margin of marginal cell; free part of marginal cell more than twice as long as rest of cell, longer than distance from apex of cell to wing tip; apex of marginal cell pointed almost on wing margin; second submarginal cell about half as long as first, receiving recurrent veins at base and apex, or first recurrent vein interstitial or received at apex of first submarginal cell; propodeum with horizontal surface curving evenly onto vertical surface so that there is not even a suggestion of a line between them, but it seems reasonable to say that the horizontal surface is about as long as the vertical one seen in profile; triangle not or scarcely defined but virtually all on horizontal surface, as can be judged by high level of propodeal pit. Metasoma slender in male, widest at third segment, second tergum with lateral fovea punctiform, gradulus not clearly evident; first tergum of male slightly more than 1.5 times as long as broad seen from above, second tergum (exposed part) nearly as long as broad; first tergum of female broader than long; seventh and eighth sterna of male flat, thinly sclerotized, hairless, the former with two apically directed lobes having broad bases.

DISTRIBUTION: Victoria to southern Queensland.

INCLUDED SPECIES

- Hylaeus (Edriohylaeus) minusculus* (Cockerell, 1913a) (*Prosopis*) (B.M.)
ofarrelli Michener, new species (Q.M.)

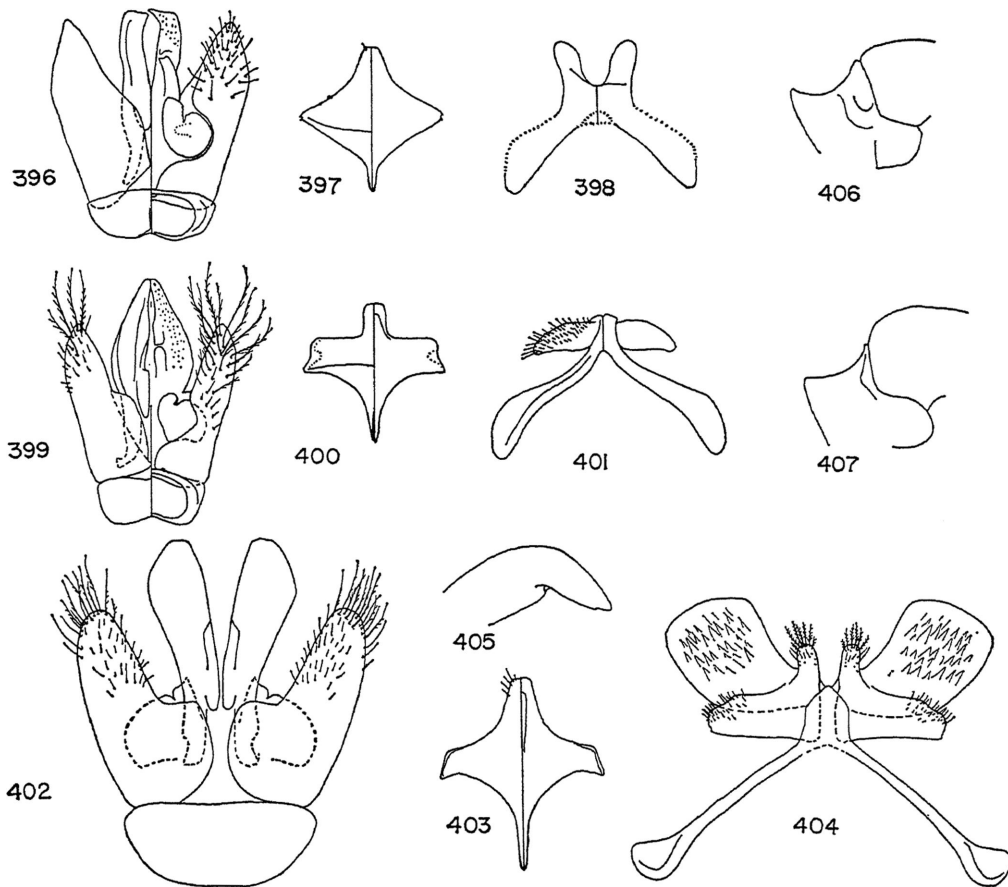
The species *minusculus* is included on the basis of my notes made before the distinctive features of this group were recognized. There is no certainty that it agrees with *Edriohylaeus* in the peculiar sternal characters of the male.

RHODOHYLAEUS, NEW SUBGENUS

Plate 9, figures 1, 2; text figures 399-401, 406

TYPE: *Prosopis cenibera* Cockerell, 1910.

This subgenus includes a large group of small species of Australian *Hylaeus* with the metasoma red (largely black in *indecisus*) and often also with red on the head and thorax. They are perhaps related to *Prosepisteron*, but differ from it and from all other Australian



FIGS. 396-407. Hylaeinae. 396-398. Male genitalia and eighth and seventh sterni of *Hylaeus* (*Edriohylaeus*) *ofarrelli*. 399-401. Same of *H.* (*Rhodohylaeus*) *ceniberus*. 402-404. Sketches of same of *H.* (*Hylaeateron*) *pulchricrus* (type); dorsal view of genitalia and ventral views of sterni. 405. Side view of penis valve of *H.* (*H.*) *pulchricrus*. 406, 407. Side view of pronotum and front of scutum of *H.* (*Rhodohylaeus*) *ceniberus* and *H.* (*Hylaeateron*) *hemirhodus*.

Hylaeinae in having a *distinct angle or feeble carina separating the anterior and relatively smooth surface, from the lateral and punctate surface of each mesepisternum, at least below.*

Mandibles two- or in some cases three-toothed in females; distance between antennae two or more times clypeo-ocular distance; subantennal sutures one to one and one-half times as long as diameter of antennal socket; *paraocular ridges present*, in some cases carinate. Claws with prongs subparallel. Wings in some cases with large bare areas basally; stigma two-thirds to more than three-fourths as long as costal edge of marginal cell; free part of marginal cell one and

one-half to two times as long as rest, as long as or slightly longer than distance from apex of cell to wing tip, apex of cell bent away from wing margin; second submarginal cell slightly more than half as long as first (nearly two-thirds in *indecisus*), receiving both recurrent veins or one or both may be interstitial; propodeum with dorsal surface one-half as long as to almost as long as vertical one (seen in profile), the two curving one onto the other or an angle between them; triangle large, one-third or rarely only about one-fourth of its length vertical, areolate with carinae which may be weak, surface often dull. Fovea of second tergum absent or

punctiform, gradulus slightly recurved and usually exposed; seventh sternum with a single pair of apical lobes provided with slender hairs; gonocoxites robust, blunt, with long hairs apically.

One species of the subgenus (*proximus*) has the clypeus broader than long, an unusual feature in *Hylaeus*. The same species is unusual in having the angle between the anterior and lateral surfaces of the mesepisternum distinct primarily above the lower end of the pre-episternal groove while in other species it is distinct below that point. Unfortunately the male of *proximus* is not known to me; possibly it will prove to be unrelated to other *Rhodohylaeus*.

The largest and by far the most coarsely sculptured species is *maiellus*, in which the sharp angle between the anterior and lateral surfaces of the mesepisternum is continued upward onto the pronotum, the gradulus of the second tergum is nearly straight, the mandibles of the female are clearly tridentate, and the paraocular ridges are carinate. The male sterna and genitalia as well as most other features indicate that *maiellus* is an aberrant *Rhodohylaeus*.

DISTRIBUTION: Australia, north as far as northern Queensland and Darwin.

INCLUDED SPECIES

- Hylaeus* (*Rhodohylaeus*) *ancoratus* (Cockerell, 1912a) (*Prosopis*) (B.M.)
cemiberus (Cockerell, 1910d) (*Prosopis*) (B.M.)
colei Rayment, 1935 (C.S.I.R.O.)
constrictiformis (Cockerell, 1910c) (*Prosopis*) (B.M.)
constrictus (Cockerell, 1905e) (*Prosopis*) (B.M.)
coronatulus (Cockerell, 1914i) (*Prosopis*) (B.M.)
coronatus (Cockerell, 1905e) (*Prosopis*) (B.M.)
haematopodus (Cockerell, 1913a) (*Prosopis*) (B.M.)
indecisus Cockerell, 1929c (A.M.)
lateralis (Smith, 1879) (*Prosopis*) (B.M.)
maiellus Rayment, 1935 (C.S.I.R.O.)
melanocephalus (Cockerell, 1922) (*Prosopis*) (Q.M.)
meriti Rayment, 1935 (C.S.I.R.O.)
perrufus Cockerell, 1929d (Q.M.)
proximus (Smith, 1879) (*Prosopis*) (B.M.)
rubripes Friese, 1924 (desc.)
rufipes (Smith, 1853) (*Prosopis*) (B.M.)
semicastaneus (Cockerell, 1918b) (*Euryglossa*) n. comb. (Q.M.)
simillimus Rayment, 1935 (C.S.I.R.O.), not

Prosopis simillimus Smith, 1879; not re-named because perhaps only a variant of *lateralis*
subconstrictus (Cockerell, 1922a) (*Prosopis*) (Q.M.)
sublateralis (Cockerell, 1914i) (*Prosopis*) (B.M.)
subplebeius (Cockerell, 1905e) (*Prosopis*) (B.M.)

HYLAETERON, NEW SUBGENUS

Plate 9, figure 3; text figures 402-405, 407, 435

TYPE: *Prosopis pulchricrus* Cockerell, 1915.

This small subgenus consists of three rather small but heavy-bodied species, each known from a single specimen. They are nonmetallic, the two known females having red metasomas. The subgenus is related to *Prosopistemon* but differs not only by the body shape, as indicated by the short horizontal surface of the propodeum, but by the fact that the surface of the propodeum is coarsely reticulate with carinae, and in some cases a carina separates the horizontal from the vertical surfaces of the propodeum. The horizontal surface is much longer than in *Euprosopis* and *Euprosopoides* and different in character from that of *Euprosopella*, being covered with carinae, so that it is reticulate or rather finely areolate. The seventh sternum is like that of *Prosopistemon*, not like that of these other subgenera. A remarkable feature of *Hylae-teron* is the low posterior margin of the pronotum, as in the distantly related subgenus *Macrohylaeus*.

Mandibles of females tridentate; inter-antennal distance greater than clypeo-ocular distance, the latter about equal to greatest width of scape; *subantennal sutures less than half as long as width of antennal socket in female* (nearly absent in *semiruber*), about as long as width of socket in male. *Posterior margin of pronotum well below level of most of scutum, dorsolateral angles rounded and not distinct; anterior margin of scutum vertical*; claws with prongs subparallel; stigma less than two-thirds to about three-fourths as long as costal edge of marginal cell, apex of latter a little separated from wing margin, free part of cell longer than (in some cases nearly twice as long as) rest and longer than distance from apex of cell to wing tip; second submarginal cell half as long as first or a little more, receiving both recurrent veins or one or both interstitial or the first entering the

end of the first submarginal cell; *propodeum* with coarsely carinate-reticulate subhorizontal surface, in some species (*hemirhodus*) with a carina separating it from vertical surface, subhorizontal surface about one-third as long as vertical surface, about one-half of length of triangle on vertical surface. Second tergum with fovea rather large and round, gradulus transverse and usually hidden; seventh sternum with four broad apical lobes; eighth sternum with apical process simple.

DISTRIBUTION: New South Wales, northern Western Australia.

INCLUDED SPECIES

Hylaeus (*Hylaeateron*) *hemirhodus* Michener, new species (W.A.M.)
pulchricrus (Cockerell, 1915a) (*Prosopis*) (B.M.)
semirufus (Cockerell, 1914i) (*Euryglossa*) n. comb. (B.M.)

GNATHOPROSOPIDES, NEW SUBGENUS

Plate 9, figures 4, 5; text figures 411–413, 439

TYPE: *Prosopis eburniella* Cockerell, 1912.

This group is related to *Gnathoprosopis*, with which it agrees in the presence of a pre-occipital carina and in the short broad mandibles. It differs, however, in the relatively smooth propodeum, the often rounded rather than truncate inner apical mandibular region, with the mandible not always broadest at the apex, and in the shape of the eighth sternum of the male. It differs from the description of *Gnathoprosopis* as follows:

Mandibles widest medially or basally, in some cases more than twice as long as broad, inner apical area rounded or subtruncate; scape enlarged in males of group a; stigma three-fourths as long as costal edge of marginal cell or more; free part of marginal cell two or more times as long as rest, apex of cell very close to wing margin; dorsal part of pronotum not at all turgid-appearing in group b; propodeum relatively smooth, not areolate, horizontal part curving onto vertical part, with no carina or sharp angle separating the two; seventh sternum of male with two pairs of broad apical lobes (both broad and somewhat rounded in group b, pointed laterally and anteriorly in group a); eighth sternum with lateral "shoulders" truncate, not produced posteriorly.

DISTRIBUTION: Tasmania and Australia from Victoria to central Queensland.

This subgenus is divisible into two groups, some of the characters of which are indicated in the above description. Group *a* consists of relatively large, elongate bees; *b* contains small compact species. In addition to the characters listed above, it may be noted that in males of group *a* but not of group *b*, there is a shining, longitudinal, mesosternal prominence anteromesially from the subpleural signum and a pair of tubercles, one on each side of the third metasomal sternum.

INCLUDED SPECIES

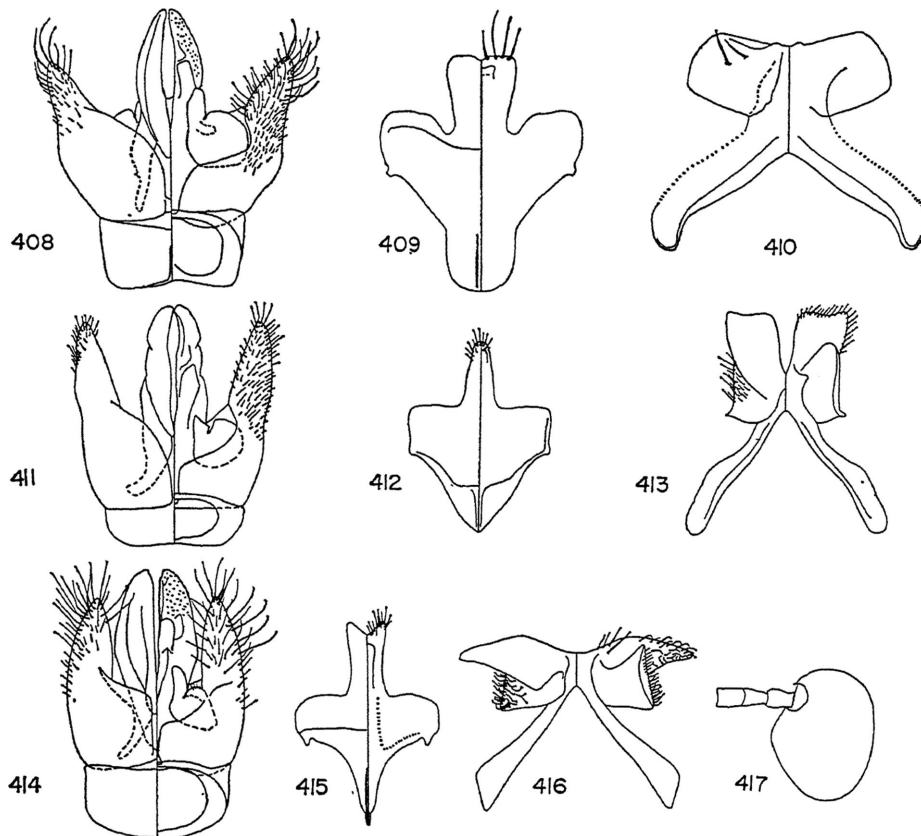
Hylaeus (*Gnathoprosopoides*) (a) *aureopictus* (Cockerell, 1929d) (*Gnathoprosopis*) n. comb. (Q.M.)
 (a) *bituberculatus* (Smith, 1879) (*Prosopis*) (B.M.)
 (a) *borchii* (Rayment, 1935) (*Gnathoprosopis*) (C.S.I.R.O.)
 (b) *eburniellus* (Cockerell, 1912a) (*Prosopis*) (U.S.N.M.)
 (b) *philoleucus* (Cockerell, 1910d) (*Prosopis*) (B.M.)
 (a) *tasmanicus* Cockerell, 1926c (B.M.)

SUBGENUS GNATHOPROSOPIS PERKINS

Plate 9, figures 6, 7; text figures 408–410, 440, 441

Gnathoprosopis PERKINS, 1912, p. 104. Type: *Prosopis xanthopoda* Cockerell, 1910 = *P. euxantha* Cockerell, 1910 (original designation).

This subgenus consists of forms which are black (metallic blue in *chromaticus*, *albonitens*, and *albipes*) with limited yellow or white markings and with a red metasoma in *theodorei*. The group has usually received generic recognition, but, as shown in the discussion under the genus *Hylaeus*, one group of *Prosopistemon* so closely approaches it, especially through *Gnathoprosopides*, that the positions of certain species seemed doubtful. The group is relegated to the subgeneric level, since in its total aggregate of characters it is close to *Prosopistemon*. The most distinctive feature of the subgenus is the mandibular shape, which is short and very broad, broadest apically (except in *xanthocollaris*) less than twice as long as broad, owing largely to the expansion of the inner apical tooth to form a broadly rounded or truncated apical margin (obliquely truncated in *xanthocollaris*) not or



FIGS. 408-417. Hylaeinae. 408-410. Male genitalia and eighth and seventh sterna of *Hylaeus* (*Gnathoprosopis*) *hackeri*. 411-413. Same of *H.* (*Gnathoprosopoides*) *eburniellus*. 414-416. Same of *H.* (*Sphaerhylaues*) *bicolorrellus*. 417. Scape and base of flagellum of male of *H.* (*S.*) *bicolorrellus*.

little exceeded by the outer mandibular tooth. The mandibles of *Gnathohylaeus* of the Philippine Islands are not nearly so broad. The presence of two ventral tubercles on the third sternum of the male is not characteristic of *Gnathoprosopis*, as might be thought from generic assignments by certain melittologists, for such tubercles occur in various related groups as well, notably *Sphaerhylaues*, *Gnathoprosopoides*, and some *Prosopistemon*, and are lacking in several true *Gnathoprosopis*.

Mandibles as described above; *preoccipital carina* present; interantennal distance greater than clypeo-ocular distance; subantennal suture one to nearly two times as long as diameter of antennal socket. Claws with prongs parallel; stigma three-fourths as long as costal edge of marginal cell or less, free

part of cell much longer than, in some cases more than twice as long as, rest of cell and longer than distance from apex of cell to wing tip; apex of cell almost on wing margin or distinctly separated from it; second submarginal cell less than half as long as first, receiving both recurrent veins or first received near end of first submarginal cell; dorsal margin of pronotum and pronotal lobes usually with a turgid aspect (not true of *albonitens*, *theodorei*); propodeum with horizontal surface half as long as vertical surface, as seen in profile, triangle with one-third to one-half of its length on vertical surface; horizontal part of propodeum areolate and separated by carina from vertical surface; seventh sternum of male with one pair of apical lobes large, the other small and in-

conspicuous; eighth sternum with lateral parts produced posteriorly on each side of base of median process.

DISTRIBUTION: Australia north to central Queensland.

INCLUDED SPECIES

- Hylaeus* (*Gnathoprosopis*) *albipes* (Friese, 1924) (*Prosopis*) ("typus" A.M.N.H.). Not *Prosopis albipes* Panzer, 1809; not renamed because probably a synonym of *chromaticus*
albonitens (Cockerell, 1905j) (*Prosopis*) (B.M.)
amiculiformis (Cockerell, 1909b) (*Prosopis*)
amiculinus (Cockerell, 1922a) (*Gnathoprosopis*) n. comb. (Q.M., pin only; paratype U.S.N.M.)
asinellus (Smith, 1879) (*Prosopis*)
asinellus (Cockerell, 1913a) (*Prosopis*) (desc.).
 Subgenus not certain
chromaticus (Cockerell, 1912a) (*Prosopis*)
euxanthus (Cockerell, 1910d) (*Prosopis*) (= *Prosopis xanthopoda* Cockerell, 1910c, not Vachal, 1895) (B.M.)
hackeri (Cockerell, 1912d) (*Gnathoprosopis*) n. comb. (Q.M.)
maculatus (Rayment, 1929c) (*Gnathoprosopis*) n. comb. (C.S.I.R.O.)
millariellus (Rayment, 1953a) (*Gnathoprosopis*) n. comb. (C.S.I.R.O.)
nigritarsus (Rayment, 1929c) (*Gnathoprosopis*) n. comb. (N.M.V.)
rowlandi (Cockerell, 1914g) (*Gnathoprosopis*) n. comb. (B.M.)
simpliciventris (Cockerell, 1922) (*Gnathoprosopis*) n. comb. (Q.M.)
theodori (Perkins, 1912) (*Gnathoprosopis*) n. comb. (B.M.)
volatilis (Smith, 1879) (*Prosopis*) (B.M.)
xanthocollaris (Rayment, 1935) (*Gnathoprosopis*) n. comb. (C.S.I.R.O.)

SUBGENUS SPHAERHYLAEUS COCKERELL

Plate 9, figure 8; text figures 414-417

Sphaerhylaenus COCKERELL, 1929c, p. 217. Type: *Gnathoprosopis globulifera* Cockerell, 1929 (monobasic).

This subgenus appears to be a derivative of the *bidentatus* group of *Prosopistemon*. Some species of that group have swollen scapes and mesosternal ridges, which are among the distinctive features of *Sphaerhylaenus*. Others, such as *bidentatus*, have lateral tubercles on the third sternum as in *Sphaerhylaenus*. The long second submarginal cell and the presence of a preoccipital carina separate *Sphaerhylaenus* from the few *Prosopistemon* which

approach it in their characteristics. The apical lobes of the seventh sternum are of the general style of *Prosopistemon* (group of *bidentatus*) but more slender. The species are not metallic.

Mandibles of ordinary shape; scape of male enormous, almost globular, face above antennae smooth, depressed to receive scape; inter-antennal distance slightly greater than to nearly twice clypeo-ocular distance; sub-antennal suture longer than diameter of antennal socket; preoccipital carina present; claws with prongs about parallel; stigma in *globuliferus* slender, parallel sided, in *bicolorellus* of normal form for the group; stigma more than twice as long as prestigma, more than half as long as costal margin of marginal cell, free part of cell equal to rest and to distance from apex to wing tip, apex of cell bent away from costa; second submarginal cell long, only slightly shorter than first in *globuliferus* and more than two-thirds as long as first in *bicolorellus*, receiving both recurrent veins, the second one-fourth of length of cell from apex in *globuliferus*, in *bicolorellus* first interstitial or entering apex of first submarginal cell; mesosternum (male) with large, shining, longitudinal ridge mesal to subpleural suture; propodeum dull, with large horizontal surface which is coarsely rugose and rounds evenly onto vertical surface, horizontal surface one-third as long as vertical or less in profile. Second tergum with large (as large as diameter of base of hind tibia), more or less round fovea laterally which, in *globuliferus*, is elevated along upper margin; gradulus of second tergum very weakly procurved, not ordinarily visible; third sternum of male with very large lateral projections (*globuliferus*) or a lateral tubercle (*bicolorellus*); seventh and eighth sterna and genitalia much as in *Prosopistemon* (see figures) and similar in the two species.

DISTRIBUTION: New South Wales, Western Australia.

INCLUDED SPECIES

- Hylaeus* (*Sphaerhylaenus*) *bicolorellus* Michener, new name for *Sphaerhylaenus bicoloratus* Rayment, 1948b, Australian Zool. vol. 11, p. 250, not *Prosopis bicoloratus* Smith, 1853 (C.S.I.R.O.)
globuliferus (Cockerell, 1929c) (*Gnathoprosopis*) n. comb. (A.M.)

SUBGENUS *EUPROSOPIS* PERKINS

Plate 9, figures 9-12; text figures 370, 421-423

Euprosopis PERKINS, 1912, p. 106. Type: *Prosopis husela* Cockerell, 1910 (original designation).

This subgeneric name has been used (usually at the generic level) for a group of species with extensive yellow facial markings and red metasomas (group *a* in list of species below). However, in all morphological features this group resembles those listed in group *b* below which are black to metallic blue with limited yellow markings. The relation of the subgenus to *Prosopistemon* is perhaps shown by *cyanophilus*, as is discussed under *Prosopistemon*.

Mandible of female bidentate or with a third tooth; malar space more than half as long as mandibular width; interantennal distance equal to or greater than clypeo-ocular distance which is much greater than diameter of scape; subantennal suture one and one-half to two times as long as diameter of antennal socket. Claws with teeth slightly divergent; wings often bare basally; stigma more than half to more than two-thirds as long as costal edge of marginal cell, free part of cell equal to or slightly longer than rest, equal to or slightly shorter than distance from apex of cell to wing tip, apex of cell slightly separated from wing margin; second submarginal cell about two-thirds as long as first, receiving both recurrent veins or one or both may be interstitial or the first may enter first submarginal cell; propodeum with very short basal subhorizontal areolate zone, posterior margin of which is marked by distinct angle and carina, most of triangle therefore on vertical surface. Second tergum without or with punctiform lateral fovea, gradulus straight; seventh sternum of male with four apical lobes, mediodistal pair slender, ribbon-like, subparallel basally, curved outward apically; eighth sternum with apical process simple.

DISTRIBUTION: Tasmania and Australia north as far as northern Queensland. Group *a* is not known in Tasmania. Group *b* is not known north of southern Queensland.

INCLUDED SPECIES

Hylaeus (*Euprosopis*) (*b*) *amatiformis* Cockerell, 1929c (A.M.)

- (b) *basalis* (Friese, 1924) (*Prosopis*), not *Prosopis basalis* Smith, 1873, not renamed because probably a synonym of *disjunctus* ("typus" A.M.N.H.)
- (a) *butleri* (Rayment, 1930a) (*Euprosopis*) n. comb. (desc.)
- (b) *capitatus* (Friese, 1924) (*Prosopis*) (desc.)
- (b) ?*chrysaspis* (Cockerell, 1910i) (*Prosopis*) (Berlin*)
- (b) *chrysognathus* (Cockerell, 1910i) (*Prosopis*) (Berlin*)
- (b) *cognatus* (Smith, 1879) (*Prosopis*) (B.M.)
- (b) *daveyi* (Cockerell, 1921) (*Prosopis*) (Q.M.)¹
- (b) *disjunctus* (Cockerell, 1905j) (*Prosopis*) (B.M.)
- (a) *elegans* (Smith, 1853) (*Prosopis*) (B.M.)
- (a) *flaviceps* (Friese, 1924) (*Prosopis*) (desc.)
- (b) *gibbonsi* Cockerell, 1929c (A.M.)
- (b) *gosfordensis* Rayment, 1939 (C.S.I.R.O.)
- (b) *gracilicaudis* Cockerell, 1929c (A.M.)
- (a) *hillii* (Rayment, 1930a) (*Euprosopis*) n. comb. (desc.)
- (b) *honestus* (Smith, 1879) (*Prosopis*) (B.M.)
- (a) *huseloides* (Cockerell, 1910b) (*Prosopis*) (B.M.)
- (a) *huselus* (Cockerell, 1910b) (*Prosopis*) (B.M.)
- (a) *labiatus* (Rayment, 1930a) (*Euprosopis*) n. comb. (desc.). Preoccupied by *Mellinus labiatus* Fabricius, 1798, which is a *Hylaeus*; not renamed because probably a color variant of *elegans*
- (b) *leptospermi* (Cockerell, 1922a) (*Prosopis*) (Q.M.)¹
- (b) *leucosphaeus* (Cockerell, 1913a) (*Prosopis*) (B.M.)
- (a) *maculatus* (Rayment, 1930a) (*Euprosopis*) n. comb. Preoccupied by *Gnathoprosopis nigratarsus maculatus* Rayment (1929c); not renamed because probably a color variant of *elegans*
- (b) *maculiceps* (Friese, 1924) (*Prosopis*) ("typus" A.M.N.H.)
- (b) *musgravei* Cockerell, 1929c (A.M.)
- (a) *nodosicornis* (Cockerell, 1913a) (*Euprosopis*) n. comb. (B.M.) (irregularity of flagellum due to foreign matter)
- (a) *occidentalis* (Rayment, 1930a) (*Euprosopis*) n. comb. (C.S.I.R.O.)
- (a) *rollei* (Cockerell, 1910i) (*Prosopis*) (Berlin*)
- (b) *simillimus* (Smith, 1879) (*Prosopis*) (B.M.)
- (a) *smithii* (Rayment, 1930a) (*Euprosopis*) n. comb. (desc.). Preoccupied by *Hylaeus smithii* Forster, 1871; not renamed because a color variant of *elegans*

¹ The types of these two species should be restudied, since my notes do not show with certainty whether they belong here or in *Euprosopoides*.

- (b) *subhonestus* Cockerell, 1929d (Q.M.)
 (a) *sydneyanus* (Cockerell, 1905e) (*Prosopis*) (B.M.)
 (b) *violaceus* (Smith, 1853) (*Prosopis*) (B.M.)
 (b) *xanthosphaerus* (Cockerell, 1913a) (*Prosopis*) (B.M.)

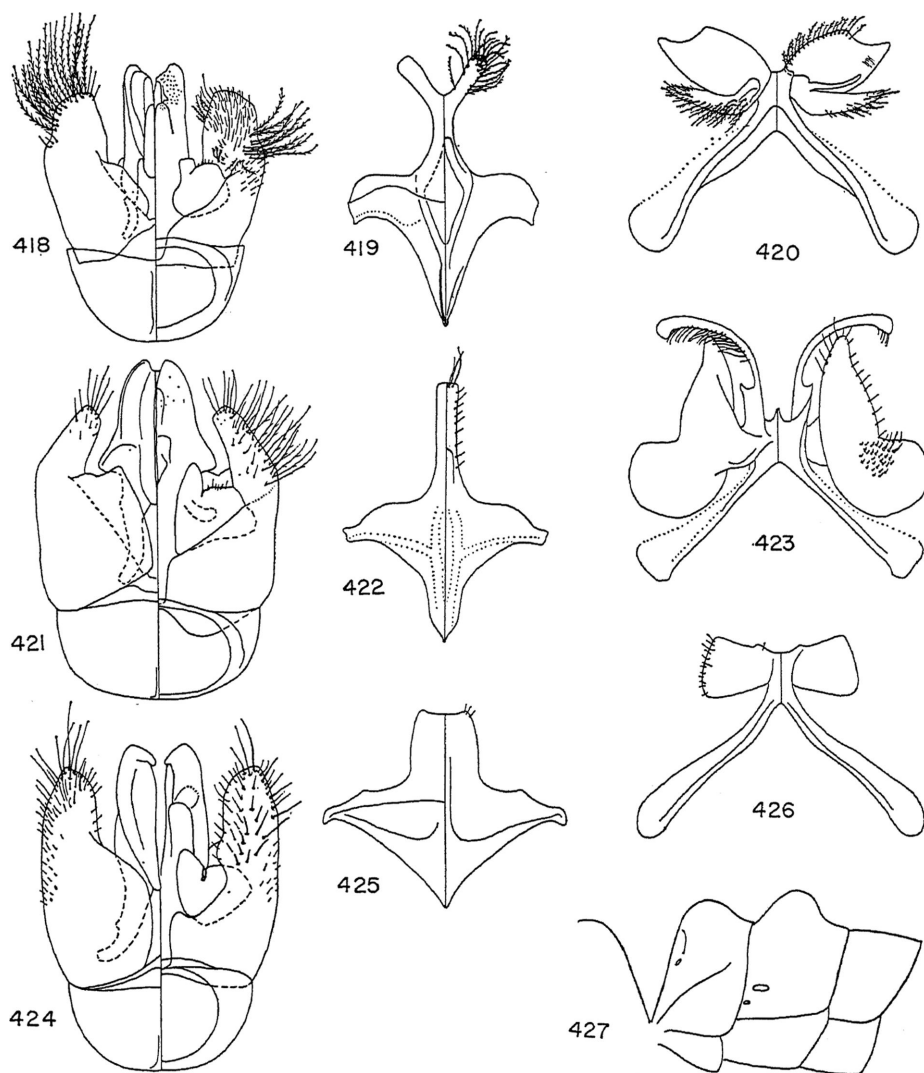
EUPROSOPOIDES, NEW SUBGENUS

Plate 9, figure 13; plate 10, figures 1, 2; text figures 418–420

TYPE: *Prosopis fulvicornis* Smith, 1853.

The species of this genus superficially resemble those of group *b* of *Euprosopis*. They agree with the description of *Euprosopis* except as follows:

Malar space less than half as long as mandibular width; clypeo-ocular distance equal to or less than diameter of scape; subantennal suture about one and one-half times as long as diameter of antennal socket; stigma about two-thirds as long as costal margin of marginal cell. *Seventh sternum of male with four*



FIGS. 418–427. Hylaeinae. 418–420. Male genitalia and eighth and seventh sterna of *Hylaeus* (*Euprosopoides*) *perconvergens*. 421–423. Same of *H.* (*Euprosopis*) *elegans*. 424–426. Same of *H.* (*Euprosopellus*) *dromedarius*. 427. Side view of base of metasoma and profile of propodeum of *H.* (*E.*) *dromedarius*, male.

apical lobes all broad (in some, as in *perconvergens*, one pair divided); eighth sternum with apical process long, deeply bifid, ending in two dark hairy lobes.

The species of this subgenus exhibit some interesting diversity. Two of them (*perplexus* and *obtusatus*) have distinct pygidial plates in the females, much broader than those of certain species of *Hyleoides*, and about like the pygidial plate of *H. (Prosopistemon) melanops*, the only other hylaeine bees with pygidial plates. *Hylaeus perplexus* has a relatively slender stigma, as might be expected in view of its large size.

Certain species have slight constrictions between the first and second terga, and even a median elevation of the first as in *Macrohylaeus*. In several species the scape of the male is slightly enlarged. The upper part of the clypeus is in some cases narrower than usual in *Hylaeus*, a condition that reaches its culmination in *perconvergens* in which the upper margin of the clypeus is only about half as long as the diameter of an antennal socket.

DISTRIBUTION: Australia, north to northern Queensland.

INCLUDED SPECIES

- Hylaeus (Euprosopoides) amatus* (Cockerell, 1909b) (*Prosopis*) (B.M.)
apouarus (Cockerell, 1910d) (*Prosopis*) (B.M.)
cassiae (Cockerell, 1910c) (*Prosopis*) (B.M.)
cyanurus (Kirby, 1802) (*Melitta*) (B.M.)
fulvicornis (Smith, 1853) (*Prosopis*)
jugatus (Cockerell, 1915b) (*Prosopis*) (B.M.)
kalamundae (Cockerell, 1915b) (*Prosopis*) (B.M.)
lubbocki (Cockerell, 1905j) (*Prosopis*) (B.M.)
major (Friese, 1924) (*Prosopis*) (desc.)
metallicus (Smith, 1862a) (*Prosopis*) (B.M.)
nigropersonatus (Cockerell, 1910c) (*Prosopis*) (B.M.)
obtusatus (Smith, 1879) (*Prosopis*) (B.M.)
pachygnathus (Cockerell, 1910c) (*Prosopis*) (B.M.)
perconvergens Michener, new species (Burns, N.M.V.)
perplexus (Smith, 1854) (*Prosopis*) = *confusa* Smith, 1853, not Nylander, 1852 (B.M.)
purpuratus (Smith, 1879) (*Prosopis*) (B.M.)
rotundiceps (Smith, 1879) (*Prosopis*) (B.M.)
ruficeps (Smith, 1853) (*Prosopis*) (B.M.)
vicinus (Sichel, 1867) (*Prosopis*) (W.)¹

EUPROSOPELLUS, NEW SUBGENUS

Text figures 424-427

TYPE: *Prosopis dromedaria* Cockerell, 1910.

This genus contains forms superficially rather like *Euprosopis* or *Euprosopoides*, *H. dromedarius* having the metasoma red and thus suggesting *H. (Euprosopis)* group *a*, the other species resembling group *b* and *Euprosopoides*. Species of this subgenus agree with the description of *Euprosopis* except as follows:

Malar space about half as long as mandibular width; clypeo-ocular distance in some cases no greater than width of scape. Propodeum with narrow, basal, pitted zone, beyond which dull surface continues horizontally, gradually curving onto vertical surface, so that perhaps one-third of the length of the triangle is horizontal. First and second terga strongly elevated middorsally, with a deep constriction between them (elevations not always so strong as in *dromedarius*); fovea of second tergum horizontally elongate, two to four times as long as broad, in some cases almost linear, gradulus of second tergum procurved and completely hidden; seventh sternum of male with two apical lobes. (See p. 338.)

DISTRIBUTION: Australia, north to southern Queensland.

INCLUDED SPECIES

- Hylaeus (Euprosopellus) certus* (Cockerell, 1921) (*Prosopis*) (U.S.N.M.)

¹ This species was based on one female and two males said to be from Auckland taken on the voyage of the "Novara" and five females and one male said to be from Tasmania (Sichel collection). The first three specimens mentioned, labeled as *vicinus*, are in the Naturhistorisches Museum, Vienna, and carry the label "Novara R., Sidney." Agreement with the description is good, and, since Sichel was notoriously inaccurate in giving localities, there seems to be no doubt that these are actually types in spite of the disagreement of the locality given by Sichel with labels on the specimens. They must have come from Sydney, New South Wales, since such bees are unknown in New Zealand. One of the males, belonging to the subgenus *Prosopistemon*, represents the "variety" described by Sichel. The other male and the female are *Euprosopoides*.

Since this female specimen was first listed by Sichel and the female is the basis of most of the description, the female in the Vienna Museum is here selected as the lectotype, and has been so labeled. It is the only one of the three in Vienna with a name label probably written by Sichel himself. The species is thus removed from the New Zealand list.

dromedarius (Cockerell, 1910i) (*Prosopis*)
(Berlin*)
perconstrictus Cockerell, 1929d (Q.M.)
pergibbosus Cockerell, 1926c (N.M.V.)

MACROHYLAEUS, NEW SUBGENUS

Plate 10, figures 3, 4; text figures 372,
428-430, 436

TYPE: *Prosopis vidua* Smith, 1853.

This subgenus is erected for a very large, robust, partially metallic blue species with a short face. It is probably derived from *Prosopistemon*, and many of its notable characters such as the slender stigma are associated with large size. *The low posterior margin of the pronotum and virtual absence of the dorso-lateral angles of the pronotum* are unique features which distinguish it from all other Australian prosopine bees except the unrelated subgenus *Hylaeteron*.

Mandible of female with outer carina abruptly bent anteriorly near base; scape of male very slightly swollen; interantennal distance about twice clypeo-ocular distance in female, greater than clypeo-ocular distance in male, but latter great (equal to width of scape); paraocular ridges present; malar space one-fourth as long as broad. Prongs of claws nearly parallel; stigma slender, parallel sided, more than twice as long as prestigma, more than half as long as costal margin of marginal cell, free part of latter as long as rest, not so long as distance from apex of cell to wing tip, apex of cell bent away from wing margin; second submarginal cell more than two-thirds as long as first, receiving second recurrent vein at least one-third of length of cell from apex, first recurrent interstitial or entering first submarginal cell near apex; mesosternum with large, median, shining, elevated area in male; propodeum with short, horizontal area (dull but not roughened), separated by strong angle but no carina from vertical surface, one-third to one-fourth of length of triangle horizontal. Lateral fovea of second tergum absent; gradulus slightly procurved, usually hidden; third sternum of male with large lateral tubercles and median transverse ridge.

DISTRIBUTION: Western Australia, Victoria, New South Wales.

INCLUDED SPECIES

Hylaetus (Macrohylaetus) alcyoneus (Erichson, 1842)
(*Prosopis*)

robustus Cockerell, 1926c (B.M.)
viduus (Smith, 1853) (*Prosopis*) (B.M.)

The above names appear to represent a single species. The type of the subgenus is designated as *Prosopis vidua*, a presumed junior synonym of *P. alcyonea*, because the type material of the latter has not been available for study.

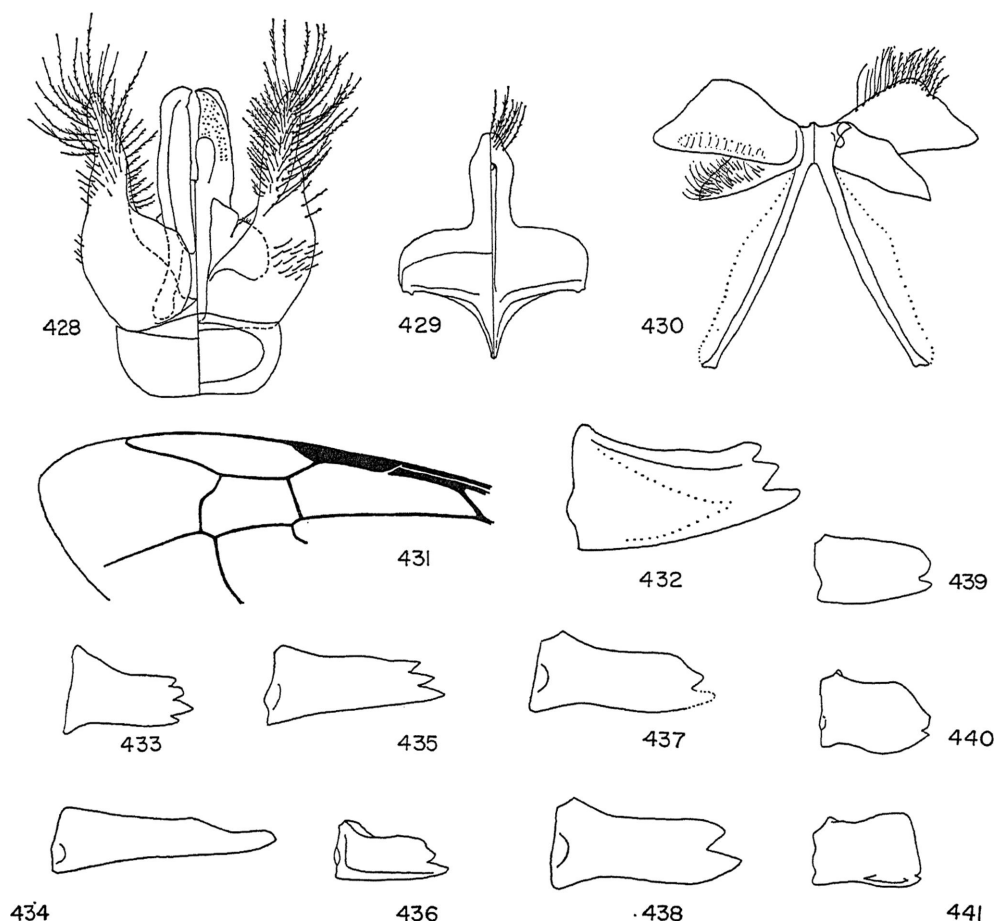
SUBGENUS MEGHYLAEUS COCKERELL

Plate 10, figure 5; text figures 431, 432

Meghylaetus COCKERELL, 1929d, p. 314. Type: *Palaeorhiza gigantea* Cockerell, 1926 (original designation).

This genus includes a single metallic blue species which, because of its very large size, suggests *Macrohylaetus* and *Sphaerhylaetus*. Unfortunately the male is unknown, but there is no doubt that *Meghylaetus* is quite unrelated to these other large forms and that such similarities as exist result from parallelisms. The *long prestigma* (see key) is unusual and distinguishes *Meghylaetus* from other hylaeine bees.

Mandibles (female) tridentate, the teeth subequal (in other Hylaeinae, a third tooth, if present, is weak and farther from the apex); interantennal distance greater than clypeo-ocular distance which, however, is great, about two times maximum diameter of scape; subantennal sutures one and one-half times as long as diameter of antennal socket; scape long, reaching well above middle ocellus; malar space nearly as long as broad. Claws with prongs divergent; *wings largely bare*, distal parts with scattered coarse, short hairs on wrinkled surface; *stigma slender, parallel sided*, more than half as long as costal margin of marginal cell, that part of margin in cell straight or scarcely convex; *free part of marginal cell shorter than rest*, equal to distance from apex of cell to wing tip, apex of cell bent a little away from costa; second submarginal cell slightly more than half as long as first, receiving both recurrent veins near its ends; propodeum with short horizontal basal zone, slightly roughened, separated by distinct sharp angle but no carina from vertical surface; triangle with about one-sixth of its length horizontal, the rest vertical. First tergum with slight median prominence (as in *Macrohylaetus* and some others); second



FIGS. 428-441. Hylaeinae. 428-430. Male genitalia and eighth and seventh sterna of *Hylaeus* (*Macrohylaesus*) *alcyoneus*. 431. Wing of *H.* (*Meghylaesus*) *fijiensis* (type). 432. Mandible of female of *H.* (*M.*) *fijiensis* (type). 433. Same of *H.* (*Prosopistemon*) *striatus*. 434. Same of *H.* (*P.*) *simplex*. 435. Same of *H.* (*Hylaeteron*) *hemirhodus* (type). 436. Same of *H.* (*Macrohylaesus*) *alcyoneus*. 437. Same of *H.* (*Prosopistemon*) *tuamotuensis*. 438. Mandible of male of *H.* (*P.*) *tuamotuensis*. 439. Same of *H.* (*Gnathoprosopoides*) *eburniellus*. 440. Same of *H.* (*Gnathoprosopis*) *xanthocollaris*. 441. Mandible of female of *H.* (*G.*) *hackeri*.

tergum with usual fovea punctiform but with large, slightly depressed, minutely hairy area below level of fovea, a similar area on third tergum; gradulus of second tergum largely hidden, slightly procurved medially.

DISTRIBUTION: Victoria. The species is now known from two Victorian localities [the Raymond Island which Cockerell (1929d) could not find on any map is in Victoria, latitude 37° 55' S., longitude 147° 44' E.]. The old specimen on which the name *fijiensis* was based must have been labeled in error, as was, no doubt, the specimen supposedly

from New Zealand on which *chalybaeus* was based.

INCLUDED SPECIES

Hylaeus (*Meghylaesus*) *chalybaeus* (Friese, 1924)¹
 (*Prosopis*) ("typus" A.M.N.H.)
fijiensis (Cockerell, 1909b) (*Prosopis*) (B.M.)
giganteus (Cockerell, 1926a) (*Palaeorhiza*)
 (N.M.V.)

These three names appear to represent the same species; unfortunately *fijiensis* has priority, although the species is Australian.

¹ For restriction of this name, see Cockerell (1926c); Friese's male was *H.* (*Macrohylaesus*) *alcyoneus*.

SUBGENUS PSEUDHYLAEUS COCKERELL

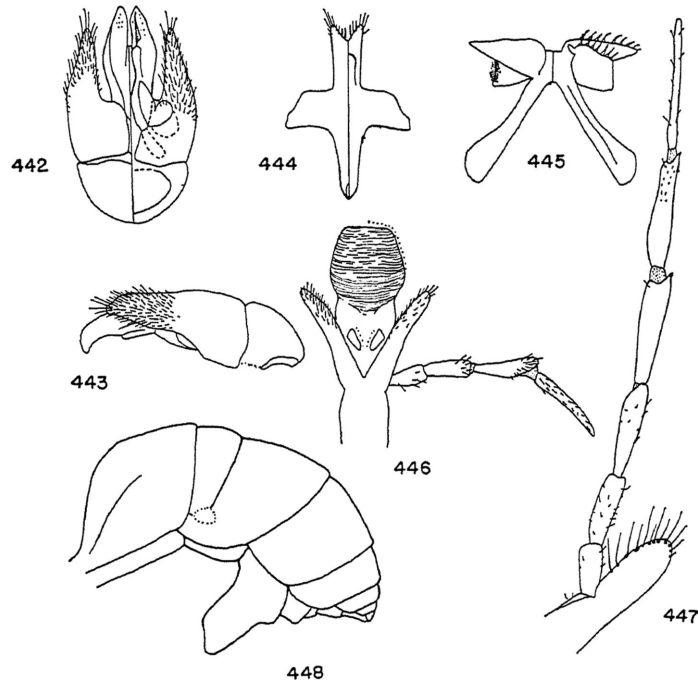
Plate 10, figures 6, 7; text figures 368,
442-448, 455

Pseudhylaesus COCKERELL, 1929d, p. 299. Type: *Euryglossa albocuneata* Cockerell, 1913 (original designation).

This name has been in use (at the generic level) for a group of species notable for the *finely sculptured, dull integument, the sericeous appearance of the metasoma due to the fine appressed pubescence, the pallid margins of the metasomal segments, and the rather robust body form* which led to the placement of some of the species in *Euryglossa*. The hidden sterna resemble those of *Hylaeus*, *sensu stricto* (*Pectinata* and *Trichota* of Méhely and of Popov), but the characters listed above separate *Pseudhylaesus* clearly from *Hylaeus*, *sensu stricto*, which is a holarctic subgenus.

Mandibles of females bidentate or tridentate; face rarely convex, usually flat to concave, in some cases longitudinally striate on

clypeus; scape of male in some cases swollen; paraocular carinae often present; interantennal distance equal to or greater than clypeo-ocular distance; subantennal suture one-half to two times as long as diameter of antennal socket; malar space absent to two-thirds as long as basal width of mandible. Prongs of claws subparallel; stigma two-thirds to four-fifths as long as costal edge of marginal cell, free part of cell much greater than the rest (but not twice as long), equal to or longer than distance from apex of cell to wing tip; second submarginal cell half as long as first or more, receiving both recurrent veins or first interstitial; propodeum dull but not coarsely roughened or carinate, with basal part sloping, curving onto vertical surface, sloping part less than half as long as vertical part, less than half of length of triangle on vertical part. *Tergal margins with laterally directed hairs*; second tergum with lateral fovea rather large and more or less round, gradulus transverse (somewhat re-



FIGS. 442-448. Hylaeinae, *Hylaeus* (*Pseudhylaesus*) *mirandus*, type. 442-445. Male genitalia (dorsoventral and lateral views) and eighth and seventh sterna. 446. Apex of labium. 447. Apex of maxilla (same scale as 446). 448. Side view of metasoma.

curved in *albocuneatus* and *mirandus*); seventh sternum of male with two pairs of broad lobes, with coarsely setose margins; apical process of eighth sternum usually notched or bifid; penis valves much exceeding gonocoxites.

Several species of this distinctive subgenus exhibit different striking features. For example, four species have enormous maxillary palpi, as long as or longer than the head, and far more robust than the labial palpi. Only one of these species, *mirandus*, has been described. It is unusual in having the malar space nearly two-thirds as long as broad, in the recurved gradulus of the second tergum, and in the enormous ventral projection of the third metasomal sternum of the male. Malar areas of various other species are smaller to absent; graduli are less recurved to almost straight, and the ventral projection of the third sternum is large in various species, including some with normal-sized maxillary palpi such as *albocuneatus*. In others the projection of the third sternum is lacking. In *multigibbosus* the third to fifth sterna all have low projections.

The pointed glossa illustrated by Rayment (1930b) for *mirandus* must have been his justification for placing the species in *Meroglossa*. The glossa of the type seemed pointed when I first examined it, because of longitudinal folding; after being softened in potash, it was seen to be truncate. The possibility that the tip had been broken off and that it is really pointed when intact exists but seems unlikely.

DISTRIBUTION: Tasmania, Australia north to southern Queensland and Western Australia.

INCLUDED SPECIES

- Hylaeus* (*Pseudhylaeus*) *albocuneatus* (Cockerell, 1913i) (*Euryglossa*) (U.S.N.M.)
albomaculatus (Smith, 1879) (*Prosopis*) (B.M.)
hypoleucus (Cockerell, 1918b) (*Euryglossa*) (Q.M.)
mirandus (Rayment, 1930b) (*Meroglossa*) n. comb. (W.A.M.)
multigibbosus Michener, new species (C.S.I.R.O.)

XENOHYLAEUS, NEW SUBGENUS

Plate 10, figures 8–11; text figures 373, 449–454

TYPE: *Hylaeus rieki*, new species.

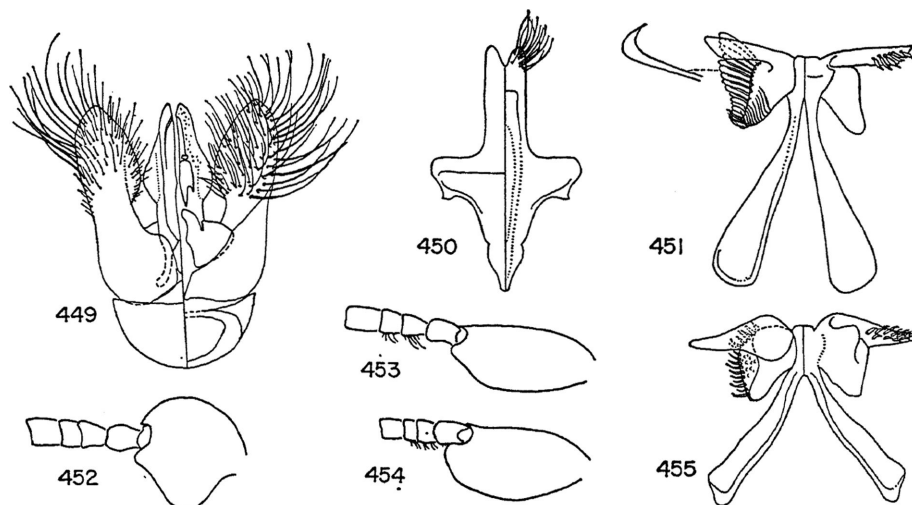
This subgenus is related to *Pseudhylaeus* as shown by the broad marginal setae (pecti-

nations) on the lobes of the seventh sternum. It resembles *Pseudhylaeus* also in its fine sculpturing, flat face, striate clypeus, and the laterally directed hairs on the margins of the terga (although these are less numerous than in *Pseudhylaeus*). It differs from *Pseudhylaeus* in the larger, more elongate body form, lack of pale tergal margins, and in several characters italicized below.

Mandibles of female bidentate or tridentate; face flat, clypeus longitudinally striate, in female with fine longitudinal median carina; scape of male broad and flat; face of male with broad deep depression on each side from clypeus to above antennal bases, as in *Meroglossa*; paraocular carina present; interantennal distance equal to or greater than clypeo-ocular distance; subantennal sutures almost twice as long as diameter of antennal socket in female, two and one-half to more than three times as long as diameter of socket and in some cases nearly as long as clypeus in male; malar space at least half as long as mandibular width. Prongs of claws subparallel; stigma two-thirds as long as costal edge of marginal cell, free part of cell longer than rest and shorter than distance from apex of cell to wing tip; second submarginal cell two-thirds as long as first or somewhat less, receiving both recurrent veins; propodeum with subhorizontal basal zone which is distinctly roughened, especially near metanotum, but curves uninterruptedly onto vertical surface which is more than twice as long as subhorizontal surface; triangle about half on vertical surface. Tergal margins with laterally directed hairs (in some cases few); second tergum with rather large, round, lateral fovea and round patch of short hairs below spiracle; similar patch of hairs on third tergum; gradulus of second tergum straight; hidden sterna as described for *Pseudhylaeus*; male genitalia with penis valves extending well beyond gonocoxites, unlike those of *Pseudhylaeus*.

Hylaeus kelvini has long been placed in *Meroglossa* because of the enlarged scape and the depressions on the face in the male, characters shared also by the two new species. Many characters show that the group is not related to *Meroglossa*.

Hylaeus procurvus is included here only tentatively. It is known to me from the single



FIGS. 449-455. Hylaeinae. 449-451. Male genitalia and eighth and seventh sterna of *Hylaeus* (*Xenohylaeus*) *rieiki*. 452-454. Base of antenna of male of *H. (X.) kelvini*, *H. (X.) scutaticornis*, *H. (X.) rieki*. 455. Seventh sternum of male of *H. (Pseudhylaeus) albocuneatus*.

male type from which the genitalia have been removed and apparently lost by the describer. It is much smaller than other *Xenohylaeus*, much like a moderately large *Prosopistemon* in appearance, and the seventh sternum might show it to be more closely related to that group than to *Xenohylaeus*. Unfortunately that sternum was neither figured nor preserved by Rayment, who illustrated the genitalia. The laterally directed hairs of the tergal margins are as in *Xenohylaeus*. The following characters differ from those of other *Xenohylaeus*, as described above: face without depressions below level of antennae; dorsolateral to each antennal base is a large, deep, dull depression extending up, near eye margin, almost to level of median ocellus; mesal to each depression is a brow-like ridge, lateral to each depression is a strong shining elevation along eye margin, highest just above level of antennal bases, and intruding into eye so that latter is emarginate; paraocular carina not present; subantennal sutures not quite twice as long as diameter of antennal socket; antennal scape expanded laterally, flat, approximately as illustrated by Rayment (1939); second submarginal cell less than two-thirds as long as first; propodeum uniformly finely punctate, not roughened basally.

DISTRIBUTION: Victoria to southern Queensland.

INCLUDED SPECIES

Hylaeus (*Xenohylaeus*) *kelvini* (Cockerell, 1912d) (*Prosopis*) (Q.M.)
procurvus (Rayment, 1939) (*Sphaerhylaeus*) n. comb. (C.S.I.R.O.)
rieiki Michener, new species (C.S.I.R.O.)
scutaticornis Michener, new species (C.S.I.R.O.)

GENUS *HETERAPOIDES* SANDHOUSE

Plate 10, figures 12, 13; text figures 371, 456-458, 460

Heterapis COCKERELL, 1911c (not Linston, 1889), p. 140. Type: *Heterapis delicata* Cockerell, 1911 (original designation).

Heterapoides SANDHOUSE, 1943, p. 557. Type: *Heterapis delicata* Cockerell, 1911 (autobasic).

This genus consists of the most slender and delicately built of the bees. It has hitherto been regarded as generically distinct because of the confluence of the second submarginal and the second medial cells. Although a single character such as this, even though striking, is not sufficient evidence for separation of a genus, the small size and very slender body, especially of the male, do provide useful supplementary characters for the group. Almost complete intergradation in body form occurs

through the subgenus *Edriohylaeus* of *Hylaeus* to species of *Prosopistemon* such as *eugeniellus*. *Edriohylaeus*, however, has such an odd seventh sternum in the male that it cannot be considered a connecting link between *Prosopistemon* and *Heterapoides*, but there is little doubt that *Heterapoides* is a derivative of *Prosopistemon*. The males of *Heterapoides* are especially distinct by the slender first tergum and the long flagellum.

Mandible normal, tapering, bidentate; antenna of male long, middle flagellar segments more than one and one-half times as long as broad, and in some cases twice as long as broad; interantennal distance greater than clypeo-ocular; subantennal suture of male much longer than diameter of antennal socket, of female subequal to it. Prongs of claws subparallel; stigma large, almost as long as costal margin of marginal cell; *free part of marginal cell three times as long as rest of cell or longer*, slightly longer than distance from apex of cell to wing tip; apex of marginal cell pointed on or slightly away from wing margin; second submarginal cell about half as long as first, *confluent with second median cell; propodeum with horizontal surface longer than vertical*,¹ triangle not or scarcely recognizable but virtually all on horizontal surface, as can be seen by high level attained by propodeal pit. *Metasoma long and slender, especially in males, in males and most females widest at third segment*; second tergum with lateral fovea punctiform, gradulus very weak, seemingly slightly recurved medially; *first tergum of male 1.5 to two times as long as broad seen from above, second tergum (exposed part) as long as or longer than broad; first tergum of female longer than broad; seventh sternum of male with four broad, laterally directed, apical lobes with hairs on them.*

DISTRIBUTION: Victoria to central Queensland.

INCLUDED SPECIES

- Heterapoides bacillaria* (Cockerell, 1914b) (*Prosopis*) n. comb. (Q.M.)
extensa (Cockerell, 1916e) (*Prosopis*) n. comb. (B.M.)

¹ In the female of *sculptus* it is almost impossible to tell where the vertical surface becomes the horizontal one because of the broad rounding of one onto the other, but I should say that the two are about equal in length.

- delicata* (Cockerell, 1911c) (*Heterapis*) (B.M.)
hackeriella (Cockerell, 1929d) (*Heterapis*) n. comb. (Q.M.)
halictiformis (Perkins, 1912) (*Heterapis*) n. comb. (B.M.)
pulchripes (Cockerell, 1914b) (*Prosopis*) n. comb. (Q.M.)
sculpta (Cockerell, 1911c) (*Heterapis*) n. comb. (B.M.)

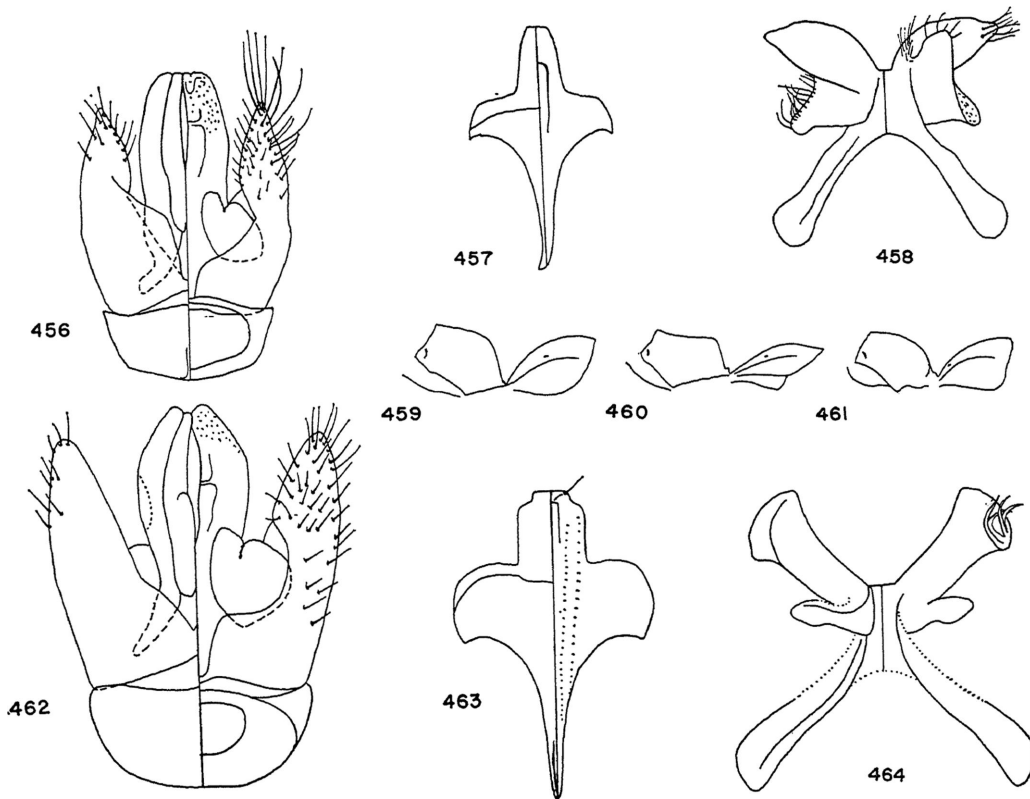
GEPHYROHYLAEUS, NEW GENUS

Plate 11, figures 1, 2; text figures 461-464

TYPE: *Heterapis sandacanensis* Cockerell, 1919.

So far as known this genus contains a single species found in the East Indies. It is nearly as slender as *Heterapoides* which it further resembles in lacking the separation between the second submarginal and second median cells. It differs from *Heterapoides* and other bees in having the metepisterna narrowed below and essentially eliminated for a considerable distance above the coxa. In this region the mesepisternum broadly meets the propodeum (fig. 461). *Gephyrohylaeus* also differs from *Heterapoides* and *Hylaeus* in having the facial foveae reduced to short depressed lines (very short in males). The new genus also has a distinct, sharp, preoccipital carina, unlike *Heterapoides*.

Mandible of the usual form, tapering to bidentate apex; antenna of male with middle flagellar segments less than 1.5 times as long as broad; interantennal distance several times as great as clypeo-ocular distance which is small, subantennal suture 1.5 (female) to nearly two times as long as diameter of antennal socket; eyes strongly converging below, in male distance between lower ends of eyes only half of distance between upper ends; *facial fovea of female reduced to short groove (about four times as long as broad) near ocular emargination, of male reduced to similarly placed pit no larger than some of the frontal punctures but about twice as long as broad; preoccipital carina or sharp ridge present.* Prongs of claws subparallel; stigma large, a little shorter than costal margin of marginal cell; *free part of marginal cell more than twice as long as rest of cell, longer than distance from apex of cell to wing tip; apex of marginal cell pointed almost on wing margin; second submarginal and second median cells*



FIGS. 456-464. Hylaeinae. 456-458. Male genitalia and eighth and seventh sterna of *Heterapoides extensa*. 459. Side view of metapleuron, propodeum, and base of metasoma of *Hylaeus* (*Edriohylaeus*) *ofarrelli*. 460. Same of *Heterapoides extensa*. 461. Same of *Gephyrohylaeus sandacanensis*. 462, 463, 464. Male genitalia and eighth and seventh sterna of *G. sandacanensis*.

confluent, the former less than half as long as first; basal vein of forewing strongly curved, distal part parallel to costal margin of wing; mesepisternum posteriorly, above middle coxa, extending back to meet propodeum, so that metapisternum is broadly interrupted; propodeum with horizontal surface curving evenly onto vertical surface so that there is not even a suggestion of a line between them, but it seems reasonable to say that horizontal surface is only slightly shorter than vertical surface seen in profile; triangle not defined but virtually all on horizontal surface, as can be judged by high level attained by propodeal pit. Metasoma slender, widest at second segment; second tergum with lateral fovea punctiform, gradulus not clearly evident; first tergum of male more than 1.5 times as long as broad seen from above, second tergum nearly as long as broad; first tergum of female

broader than long; seventh tergum of male with four apical lobes, two directed toward each side.

DISTRIBUTION: New Guinea, Borneo.

INCLUDED SPECIES

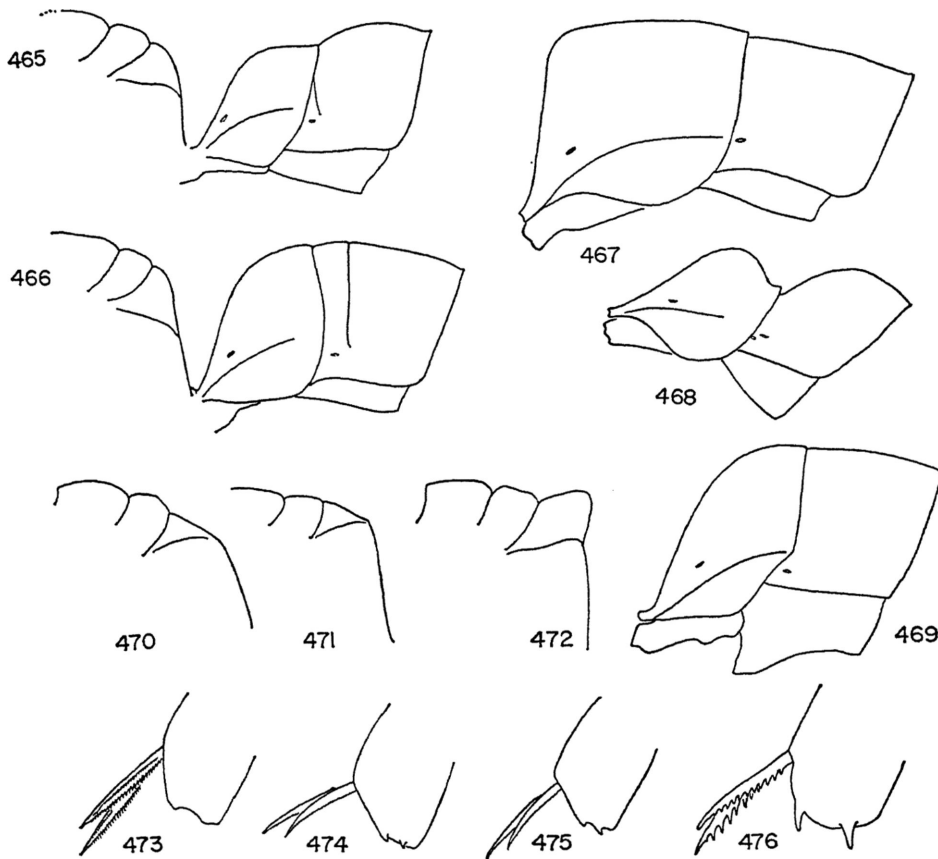
Gephyrohylaeus sandacanensis (Cockerell, 1919a) (*Heterapis*) n. comb. (U.S.N.M.) Borneo, New Guinea

GENUS ANALASTOROIDES RAYMENT

Plate 11, figure 3; text figures 465, 483

Analastoroides RAYMENT, 1950b, p. 20. Type: *Analastoroides foveata* Rayment, 1950 (monobasic and original designation).

This genus contains a single species which resembles a rather small, slender *Hyleoides concinnus* in the broad apical orange bands on the first and third terga (a paler orange band on the fourth) and even in the apical whitish



FIGS. 465-476. Hylaeinae. 465. Side view, posterior part of thorax to base of metasoma of *Analastoroides foveata*. 466. Same of *Hylaeorhiza nubilosa*. 467. Side view of base of metasoma of *Pharhylaesus lactiferus*. 468. Same of *Hemirhiza melliceps*. 469. Same of *Hyleoides concinnus*. 470. Side view of posterior part of thorax and propodeum of *Palaeorhiza (Palaeorhiza) stygica*. 471. Same of *P. (Anchirhiza) mandibularis*. 472. Same of *P. (Palaeorhiza) conica*. 473. Apex of hind tibia of female of *Hylaeorhiza nubilosa*. 474. Same of *Amphylaeus (Agogenohylaeus) nubilosellus*. 475. Same of *A. (Amphylaeus) morosus*. 476. Same of *Meroglossa canaliculatus*.

band on the second sternum. However, this color pattern is a result of short pubescence, so dense that one cannot see the surface between the hairs of the bands of the first and third terga; in *Hyleoides* the coloration is integumental. *Analastoroides* is not at all closely related to *Hyleoides* but is close to *Hylaeus* and *Hylaeorhiza*. I have not seen the male and therefore find it difficult to place the genus exactly. However, the structure of the apex of the hind tibia is as in *Hylaeorhiza*; the propodeum is almost as in that genus but with the base of the triangle more horizontal. The face marks of the female are suggestive

of those of *Hylaeorhiza burnsi*, also known only from the female. Possibly discovery of males will show that *Hylaeorhiza* or at least *H. burnsi* should be included in *Analastoroides*.

Mandibles of female tridentate; interantennal distance much more than clypeo-ocular distance; subantennal suture (female) more than 1.5 times as long as diameter of antennal socket. Stigma nearly as long as edge of marginal cell on costa; free part of marginal cell longer than rest of cell and subequal to distance from apex of cell to wing tip; apex of cell bent well away from wing

margin; second submarginal cell about two-thirds as long as first, first recurrent vein scarcely distal to first transverse cubital, second recurrent well before apex of cell; propodeum largely vertical in profile but upper part of triangle sloping, curving evenly onto vertical surface, triangle dull, not roughened; ridge in front of mesocoxa almost absent; outer apical margin of hind tibia concave behind middle, setting off an obtuse angle as in *Hylaeorhiza*. Second metasomal tergum slightly swollen, rising above level of first, lateral fovea absent, gradulus transverse, hidden; *terga (especially first and third) with broad apical bands of velvety orange pubescence.*

DISTRIBUTION: New South Wales.

INCLUDED SPECIES

Analastoroides foveata Rayment, 1950b (C.S.-I.R.O.)

PHAROHYLAEUS, NEW GENUS

Plate 11, figure 4; text figures 374, 467, 477-479

TYPE: *Meroglossa lactifera* Cockerell, 1910.

This genus contains a large, robust species that resembles some of the species of *Meroglossa*. Unfortunately it is known only in the male sex. However, the unpointed glossa of the male and the sterna and genitalia all suggest a closer relationship with *Hylaeus*.

Mandibles bidentate; glossa of male short and subtruncate; face (male) with smooth but not depressed areas below antennae, smooth, slightly depressed areas above antennae; scape not swollen; distance between antennae greater than clypeo-ocular distance; subantennal suture shorter than diameter of antennal socket; *preoccipital carina present*. Wings with large bare areas basally; stigma of moderate size, about two-thirds as long as costal edge of marginal cell, free part of cell equal to rest and shorter than distance from apex of cell to wing tip; apex of cell bent a little away from wing margin; second submarginal cell little more than half as long as first, *second recurrent vein beyond end of cell; basal vein interstitial with cu-v* (beyond cu-v in other genera); middle and hind tibial spurs thick and curved near apices. Propodeum without sculpturing, horizontal area short, set off by distinct angle from vertical area,

more than half of length of triangle vertical; ridge in front of mesocoxa sharp. *Metasoma with first three segments large, others mostly telescoped inside* and invisible except for apices of certain terga; second tergum with fovea punctiform, *gradulus absent* except for faint line visible laterally, pregradular area densely hairy (as is common in the group, but such areas are not ordinarily exposed); first three terga with sublateral, preapical convexities; third sternum (male) with a pair of submedian preapical lobes; seventh sternum of male with coarse blunt spines on ventro-apical lobe, dorsoapical lobe bare; eighth sternum with apex blunt, with few short hairs.

DISTRIBUTION: Central and northern Queensland.

INCLUDED SPECIES

Pharohylaeus lactiferus (Cockerell, 1910c) (*Meroglossa*) n. comb. (B.M.)

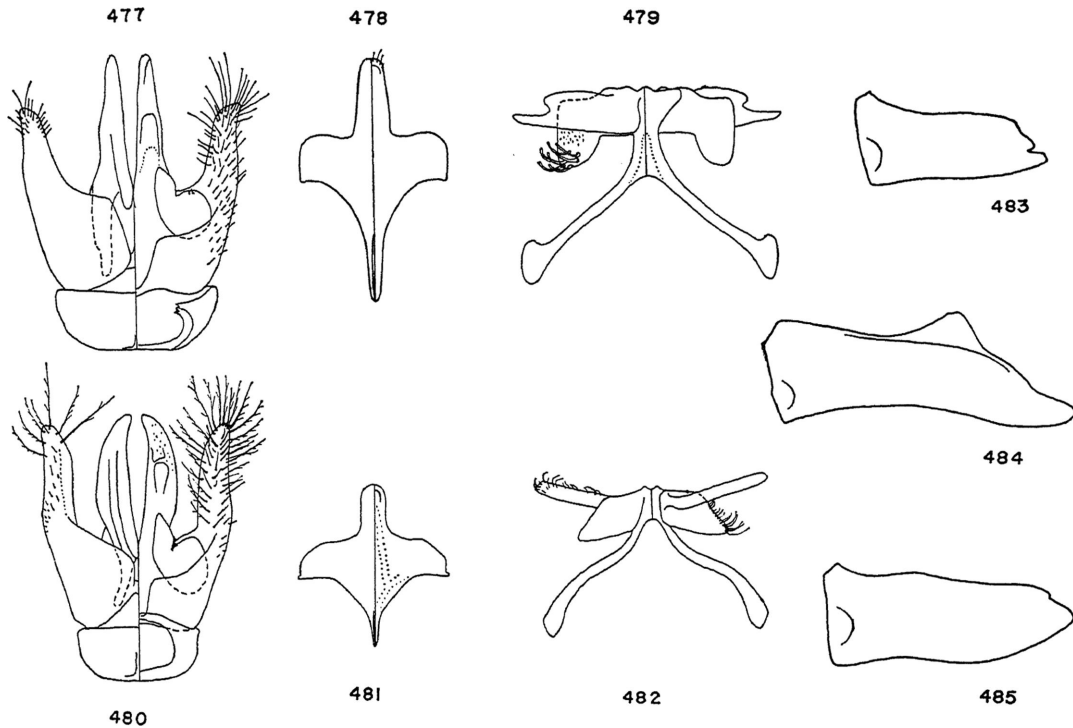
HYLAEORHIZA, NEW GENUS

Plate 11, figures 5-7; text figures 375, 466, 473, 480-482, 484, 485

TYPE: *Prosopis nubilosa* Smith, 1853.

This genus consists of *Hylaeus*-like bees which, however, exhibit many characters of *Palaeorhiza*, to the extent that Meade-Waldo included them in that genus. The genitalia and hidden sterna are similar to those of *Palaeorhiza*, as is the smooth propodeal triangle. The glossa of the male is not elongated as in *Palaeorhiza*; on the other hand it exhibits a small, median, apical point. The preoccipital carina, characteristic of *Palaeorhiza*, is absent from *Hylaeorhiza*.

Mandibles bidentate (weakly in female); glossa of male short and broad as in *Hylaeus* but with small, median, apical point; interantennal distance much more than the small clypeo-ocular distance; subantennal suture nearly twice (female) or more than twice (male) as long as diameter of antennal socket. Stigma about two-thirds as long as costal edge of marginal cell; free part of marginal cell longer than rest of cell (in some cases only slightly so), shorter than distance from apex of cell to wing tip; apex of cell rounded, a little away from wing margin; second submarginal cell one-half as long as first or a little more, receiving both recurrent veins;



FIGS. 477-485. Hylaeinae. 477-479. Male genitalia and eighth and seventh sterna of *Pharaohylaeus lactiferus*. 480-482. Same of *Hylaeorhiza nubilosa*. 483. Mandible of female of *Analastoroides foveata*. 484. Same of *Hylaeorhiza burnsi*. 485. Same of *H. nubilosa*.

propodeum largely vertical, upper part sloping and evenly rounded onto vertical part as seen in profile, triangle smooth, general aspect suggesting that of *Palaeorhiza* but much more vertical; ridge in front of mesocoxa sharp (weak in *burnsi*); outer apical margin of hind tibia, especially in female, concave behind middle, setting off an obtuse angle that is less evident in other groups. Second tergum with fovea absent, gradulus slightly recurved or straight and usually exposed; hidden sterna and genitalia of male as in *Palaeorhiza* but upper apical lobe of seventh sternum with hairs.

Nests of *H. subnubilosa*, similar to those of *Hylaeus*, were found by Rayment (1935) in abandoned wasp nests and in burrows made by the bees in adobe walls.

DISTRIBUTION: Tasmania, eastern Australia from Victoria to central Queensland.

INCLUDED SPECIES

Hylaeorhiza aureomaculata (Cockerell, 1909b)
(*Prosopis*) n. comb.

burnsi Michener, new species (Burns, N.M.V.)
nubilosa (Smith, 1853) (*Prosopis*) n. comb.
(B.M.)

spryi (Cockerell, 1926c) (*Hylaeus*) n. comb.
(N.M.V.)

subnubilosa (Cockerell, 1910c) (*Prosopis*) n.
comb. (B.M.)

tasmani (Cockerell, 1929d) (*Hylaeus*) n. comb.
(Q.M.)

Hylaeorhiza burnsi is a strange species, quite unlike the others. When the male is known, it may appear that it is improperly placed here.

GENUS PALAEORHIZA PERKINS

Plate 11, figures 8-13; plate 12, figures 1, 2;
text figures 377, 470-472, 489-499

This is the only rather large genus of bees that is centered in New Guinea and has a distribution similar to that of the birds of paradise. A rich fauna of undescribed species occurs in this island. As this distribution suggests, unlike most bees, *Palaeorhiza* is usually found in areas covered with tropical rain

forest. The species are large for the group and usually either brilliantly metallic or extensively marked with yellow.

Mandibles bidentate, in some females with a subapical inner angle so that they are tridentate, rarely without notches (or teeth) in apex; *glossa* of male slender and pointed, nearly one-fourth as long as head to as long as head; *preoccipital carina* present, at least medially. Stigma of moderate size (slender and almost parallel sided in *luxuriosa*), more than half and usually two-thirds as long as costal margin of marginal cell; marginal cell with free part longer than the rest and subequal to or longer than distance from apex of cell to wing tip, apex of cell slightly separated from wing margin; second submarginal cell nearly as long as first to only about one-third of length of first, receiving recurrent veins near ends; propodeum with large dorsal surface gently curving onto posterior surface (except in *conica* and *hamada*); dorsal surface of propodeum shorter than posterior, seen in profile; ridge in front of mesocoxa sharp. Second tergum with fovea absent or punctiform; gradulus transverse; seventh tergum of male rounded or with two apical angles (in some cases prolonged and spinelike); seventh sternum of male with upper lobe elongate, slender, in some cases twisted, hairless, lower lobe broader and fringed; eighth sternum of male with apex blunt, bare; penis valves moderately curved down apically.

I reluctantly conclude that the variation in characters among the species is so great that recognition of subgenera, beyond those indicated below, is inadvisable. *Heterorhiza* constitutes a distinctive small group. *Palaeorhiza hilara*, however, has the fluted propodeal triangle characteristic of *Heterorhiza*, but in the male metasomal characters, the ciliate inner hind tibial spur of the female, and the lack of yellow markings except on the head and pronotum, *hilara* is much more like *Palaeorhiza* proper.

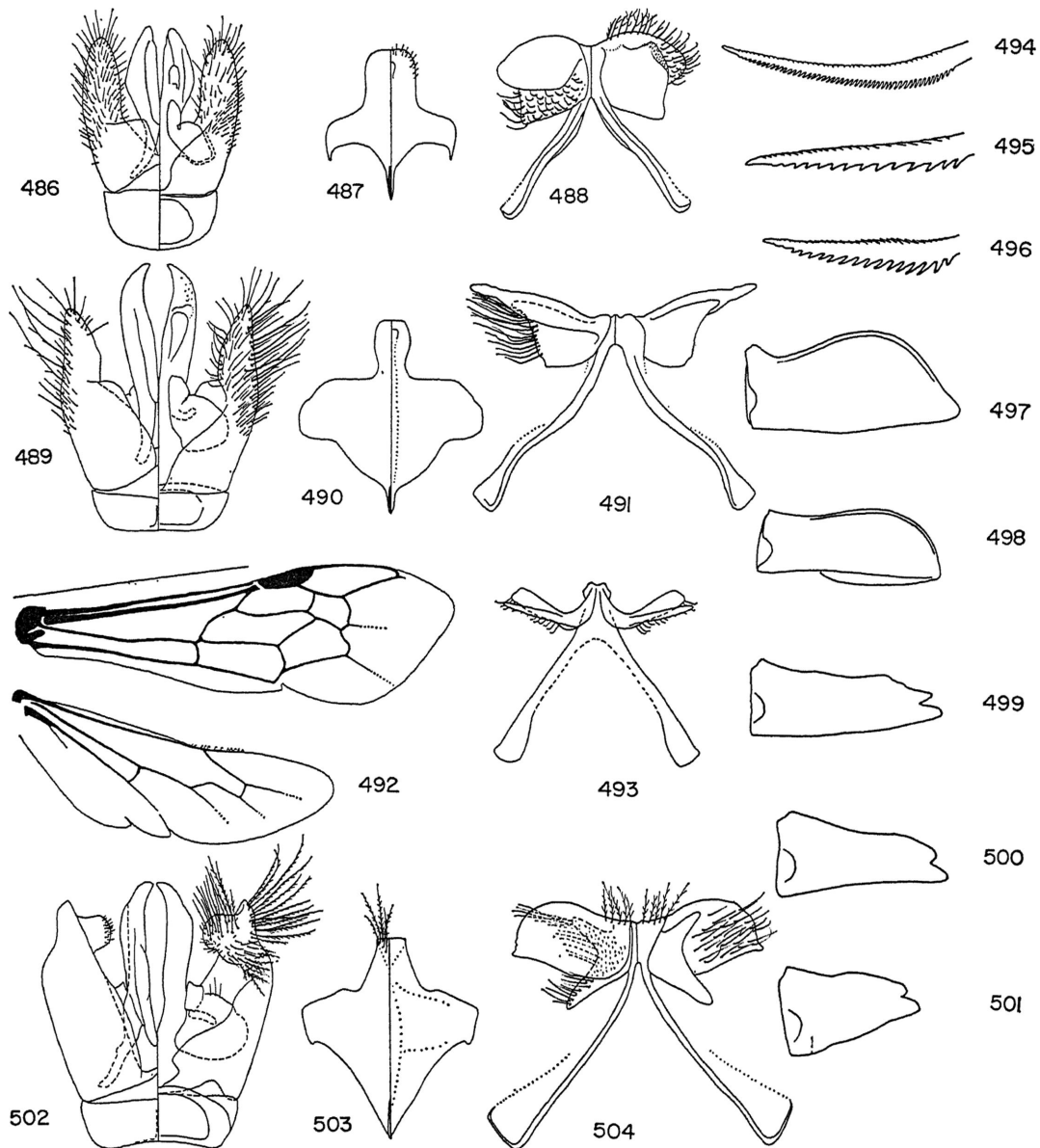
Among the forms included in *Palaeorhiza* proper, variation in a number of striking features occurs. Many of the species (constituting most of group *a* below) are strongly metallic, with yellow on the thorax, if present, limited to the pronotum, scutellum, and metanotum (propodeal triangle in *conica*) and with the metasoma wholly dark. In most

of these species the second submarginal cell is rather long, about two-thirds as long as the first, reaching a maximum in *conspicua* in which the second cell is almost as long as the first. It is reduced by insensible degrees, and in *muiri*, *bagudai*, and *violacella* the second is little more than half as long as the first. The stigma is smaller than usual in *conica* and *hamada* (subgenus *Xenorhiza*) and in *luxuriosa* and *imperialis* is almost parallel sided. Although in the last two species, the second submarginal cell is of the usual size for the group, in *hamada* it is the smallest of any *Palaeorhiza*, being only just more than one-third as long as the first. *Palaeorhiza hamada* and *luxuriosa* are unique in the enormous development of the ridge in front of the mesocoxa to form a huge tooth (in males only in *luxuriosa*, in the female, the male being unknown, in *hamada*). The propodeal triangle is irregularly roughened in *imperialis*, similarly roughened posteriorly in *luxuriosa*, while in *hamada*, as described under *Xenorhiza*, it is profoundly areolate. In *conica* the whole median part of the triangle is elevated into a high but rounded conical projection.

Reduction of the metallic coloration occurs in various species of group *a*. For example, in *concorda* the head and thorax are hardly metallic, the metasoma is green; in *rectituda* and *conspicua* the metasoma is hardly metallic, but the thorax is green; in *perkinsi* the head and thorax are only slightly metallic, and the metasoma is reddish; in *stygica* the body is black, with feeble metallic luster on the metasoma; and in *solomonis* there is no metallic coloration whatever. In *P. papuana* there is no metallic coloration, but the metasoma is red.

Several species grade into those with extensive yellow markings. Such species that have been named are *permiranda* and *patricia*. Both are somewhat metallic, with yellow areas on the scutum and pleura as well as in the areas where yellow is found in group *a*. *Palaeorhiza elegans* has the head and thorax bright green, with yellow areas on the scutum, pleura, and elsewhere.

The bees mentioned in the last paragraph are included in group *b*, characterized by extensive yellow markings, usually by lack of metallic coloration, and in general by the small second submarginal cell, about one-



FIGS. 486-504. Hylaeinae. 486-488. Male genitalia and eighth and seventh sterni of *Hemirhiza melliceps*. 489-491. Same of *Palaeorhiza (Palaeorhiza) stygica*. 492. Wings of *P. (P.) reginarum*. 493. Sketch of seventh sternum of male of *P. (P.) papuana*. 494-496. Inner hind tibial spurs of females of *P. (P.) stygica*, *P. (P.) conica*, and *P. (P.) reginarum*. 497. Mandible of females of *P. (Anchirhiza) mandibularis* (type). 498. Same of *P. (Palaeorhiza) conica*. 499. Same of *P. (P.) stygica*. 500. Same of *Amphylaeus (Agogenohylaeus) nubilosellus*. 501. Same of *A. (Amphylaeus) morosus*. 502-504. Male genitalia and eighth and seventh sterni of *A. (A.) morosus*.

third as long as the first. Typical members of this group are rather small and have exactly the appearance of *Heterorhiza*, and in *patricia* the apical tergum of the male is somewhat broadened and has its lateroapical angles acute, although not so hornlike as in *Heterorhiza*. *Palaeorhiza fulva* is placed here on the basis of its size and appearance, although the integument is largely fulvous. *Palaeorhiza infuscata* resembles this group in spite of its largely dark color.

The inner hind tibial spur of the female provides interesting characters. In species of group *a* it is coarsely pectinate in *reginarum*, *perviridis*, *cassiaefloris*, and *malachisis*. In group *b* the same is true of *permiranda*. In this respect these bees are like *Heterorhiza*. In *conica* this spur is coarsely serrate. In all other members of both groups *a* and *b*, the spur is ciliate. (Females are unknown to me in *purpureocincta*, *imperialis*, *rectituda*, *mui*, *bagudai*, *violacella*, *eboracina*, *perkinsi*, and *kurandensis*.)

Palaeorhiza papuana, the type species of *Eupalaeorhiza*, is quite unusual, for example, in having the propodeal triangle wholly horizontal and hardly curved down onto the posterior face of the propodeum, the glossa of the male as long as the head (one-fourth to one-half of this length in other species), and in having the apical lobes of the seventh sternum of the male unusually elongate and slender. These and other differences listed by Meade-Waldo seem rather minor in the light of the general diversity within the genus. The glossa of the female is normal, not acute as Meade-Waldo suggested might be the case when he described the male.

KEY TO THE SUBGENERA OF *Palaeorhiza*

1. Seventh metasomal tergum of male broad, with a pair of lateroapical horns, the apices of which are often exposed; propodeal triangle with strong radiating ridges. (Inner hind tibial spur of female pectinate; body non-metallic, with extensive yellow markings.) *Heterorhiza*
Seventh metasomal tergum of male with apex convex or shallowly concave, resultant angles rather close together and not prolonged into horns; propodeal triangle without radiating striae (except in *hilara*) 2
2. Second submarginal cell little more than one-third as long as first; propodeum with a

- complicated pattern of strong carinae, including one separating dorsal from posterior face of triangle; strong spine in front of middle coxa (female) *Xenorhiza*
Second submarginal cell about half as long as first or longer; propodeum smooth or minutely roughened and dull, irregularly more coarsely roughened posteriorly only in *luxuriosa*; strong spine in front of middle coxa absent (present in male only of *luxuriosa*) 3
3. Mandible (female) much broadened, especially at apex which is broadly convex, edentate; clypeo-ocular distance more than twice maximum diameter of scape. *Anchirhiza*
Mandible of usual form with bidentate to tridentate apex (edentate in *conica*); clypeo-ocular distance much less than twice maximum diameter of scape
. *Palaeorhiza*, *sensu stricto*

SUBGENUS *PALAEORHIZA* PERKINS

Plate 11, figures 8–11, 13; text figures 377, 470, 472, 489–496, 498, 499

Palaeorhiza PERKINS, 1908, p. 29. Type: *Prosopis perviridis* Cockerell, 1905 (monobasic and original designation).

Eupalaeorhiza MEADE-WALDO, 1914b, p. 403. Type: *Eupalaeorhiza papuana* Meade-Waldo, 1914 (monobasic and original designation).

This subgenus includes the bulk of the species and is sufficiently characterized by the key and preceding discussion.

DISTRIBUTION: Centered in New Guinea but extending south to southern Queensland and to the Darwin area in Northern Territory, east to the Bismark Archipelago, the Solomon Islands, the Santa Cruz Islands and the New Hebrides, and west to Misool Ambon, Buru, and Timor.

INCLUDED SPECIES

- Palaeorhiza* (*Palaeorhiza*) (b) *apicata* (Smith, 1863) (*Prosopis*) (Ox.) Misool
(a) *bagudai* Cheesman, 1948 (B.M.) New Guinea
(b) *basilura* Cockerell, 1910b (B.M.)
(a) *caerulescens* (Friese, 1924) (*Prosopis*)
(a) *cassiaefloris* (Cockerell, 1910c) (*Meroglossa*) (B.M.)
(a) *concorda* Cheesman, 1948 (B.M.) New Guinea
(a) *conica* Michener, new species (Bishop) New Guinea
(a) *conspicua* Cheesman, 1948 (B.M.) New Guinea

- (a) *disrupta* Cockerell, 1914b (B.M.)
- (a) *eboracina* (Cockerell, 1910c) (*Meroglossa*) (B.M.)
- (b) *elegantissima* (Dalla Torre, 1896) (*Prosopis*) = *Prosopis elegans* Smith, 1864, not 1853 (Ox.) New Guinea
- (b) *flavomellea* Cockerell, 1910b (B.M.)
- (b) *fulva* Cheesman, 1948 (B.M.) New Guinea
- (b) *gacellae* (Friese, 1924) (*Prosopis*) ("typus" A.M.N.H.) New Britain
- (a) *gratiosa* Cheesman, 1948 (B.M.) New Guinea
- (a) *hilara* Cheesman, 1948 (B.M.) New Guinea
- (a) *humeralis* (Friese, 1924) (*Prosopis*) (desc.)
- (a) *imperialis* (Smith, 1863) (*Prosopis*) (B.M.) New Guinea
- (b) *infusata* Michener, new species (B.M.) Santa Cruz Islands
- (b) *jutefae* Cheesman, 1948 (B.M.) New Guinea
- (a) *kurandensis* (Cockerell, 1909b) (*Prosopis*) (B.M.)
- (a) *luxuriosa* (Cockerell, 1910c) (*Meroglossa*) (B.M.)
- (a) *malachisis* (Smith, 1859b) (*Prosopis*) (Ox.) Kai
- (b) *maluae* Cheesman, 1948 (B.M.) New Hebrides
- (a) *muiri* Perkins, 1912 (B.M.) Ambon
- (b) *niveicollis* (Friese, 1924) (*Prosopis*) (A.M.N.H.) New Britain
- (a) *optima* Cockerell, 1929b (A.M.N.H.)
- (b) *oqualiensis* Cheesman, 1948 (B.M.) New Guinea
- (a) *papuana* (Meade-Waldo, 1914b) (*Eupalaeorhiza*) (B.M.) New Guinea
- (a) *parallela* (Cockerell, 1905j) (*Prosopis*) (B.M.)
- (a) *patricia* Cheesman, 1948 (B.M.) New Guinea
- (a) *perkinsi* (Cockerell, 1910i) (*Palaeorhiza*) (Berlin*)
- (b) *permiranda* (Cockerell, 1909b) (*Prosopis*) (B.M.)
- (a) *perviridis* (Cockerell, 1905j) (*Prosopis*) (B.M.)
- (a) *poecilosoma* Alfken, 1926 (*Prosopis*) (desc.) Buru
- (a) *purpurascens* (Friese, 1924) (*Prosopis*) (desc.)
- (a) *purpureocincta* Cockerell, 1926c (N.M.V.)
- (a) *recessiva* Cockerell, 1912a (B.M.)
- (a) *rectituda* Cheesman, 1948 (B.M.) New Guinea
- (a) *regalis* (Friese, 1924) (*Prosopis*) (desc.)
- (a) *regina* (Friese, 1924) (*Prosopis*) ("typus" A.M.N.H.)
- (a) *reginarum* (Cockerell, 1905j) (*Prosopis*) (B.M.)

- (a) *rejecta* Cockerell, 1929b (A.M.N.H.)
- (a) *stygica* Michener, new species (Bishop) New Guinea
- (b) *tetraxantha* (Cockerell, 1911b) (*Meroglossa*) (C.S.I.R.O.) Solomon Islands
- (a) *turneriana* (Cockerell, 1905j) (*Prosopis*) (B.M.)
- (a) *varicolor* (Smith, 1879) (*Prosopis*) (B.M.) = *variicolor* (Dalla Torre, 1896), unnecessary emendation
- (a) *viridifrons* Cockerell, 1921 (Q.M.)
- (a) *viridimutans* (Cockerell, 1910c) (*Meroglossa*) (B.M.)
- (a) *violacella* Michener, new name for *Prosopis violacea* Friese, 1924, Konowia, vol. 3, p. 230, not Smith, 1853 ("typus" A.M.N.H.) Timor¹

SUBGENUS **HETERORHIZA** COCKERELL

Plate 12, figures 1, 2

Heterorhiza COCKERELL, 1929d, p. 316. Type: *Palaeorhiza melanura* Cockerell, 1910 (original designation).

The characters of this subgenus are presented in the key to subgenera and in the discussion under the genus *Palaeorhiza*.

DISTRIBUTION: Central Queensland to New Guinea, Misool, Batjan. (Dr. M. A. Lieftinck writes that the subgenus also occurs on Obi and as far west as Flores in the Lesser Sundas.)

INCLUDED SPECIES

- Palaeorhiza (Heterorhiza) denticauda* (Cockerell, 1910c) (*Meroglossa*) (B.M.)
- enixa* Cheesman, 1948 (B.M.) New Guinea
- exima* (Smith, 1861) (*Prosopis*) (Ox.) Batjan
- ferruginea* (Friese, 1911b) (*Prosopis*) (desc.) New Guinea
- hedleyi* Cockerell, 1929c (A.M.)
- longiceps* (Friese, 1924) (*Prosopis*) (desc.)
- lusoria* (Smith, 1863) (*Prosopis*) (Ox.) Misool
- melanura* Cockerell, 1910b (paratype U.S.N.M.)

XENORHIZA, NEW SUBGENUS

TYPE: *Palaeorhiza hamada* Cheesman, 1948.

Bright metallic green, like typical members of group *a* of *Palaeorhiza*, *sensu stricto*, from which it differs by the small second submarginal cell, little more than one-third of the

¹ This species is included in spite of being extralimital, because it is the only *Palaeorhiza* that occurs outside our area except for an unidentified *Heterorhiza* from Flores.

length of the first, with both recurrent veins just outside the limits of the cell; the enormous tooth or spine in front of the middle coxa of the female, and especially by the propodeum which is provided with various carinae, including one that separates the dorsal from the posterior surfaces. More than the posterior one-third of the length of the propodeal triangle is on the vertical surface of the propodeum. On the horizontal surface the limits of the triangle are nearly obscured by the coarse areolation. The sutures between the mesopleuron and metapleuron and between the latter and the propodeum are carinate below.

DISTRIBUTION: New Guinea.

INCLUDED SPECIES

Palaeorhiza (Xenorhiza) hamada Cheesman, 1948
(B.M.) New Guinea

ANCHIRHIZA, NEW SUBGENUS

Plate 11, figure 12; text figures 471, 497

TYPE: *Palaeorhiza mandibularis*, new species.

This subgenus has the size and form of typical members of group *a* of *Palaeorhiza*, *sensu stricto*, but is scarcely metallic. Its limited yellow thoracic maculations are suggestive of such forms as *parallela* and *disrupta*. It differs from *Palaeorhiza*, *sensu stricto*, in the small clypeus, broadly separated from the eyes (see key), and in the extraordinarily broad, edentate mandibles.

DISTRIBUTION: Southern Queensland.

INCLUDED SPECIES

Palaeorhiza (Anchirhiza) mandibularis Michener,
new species (Q.M.)

HEMIRHIZA, NEW GENUS

Plate 12, figures 3, 4; text figures 376, 468,
486-488

TYPE: *Palaeorhiza melliceps* Cockerell, 1918.

This genus has somewhat the appearance of a small yellow and black *Palaeorhiza* with which it agrees in the long, pointed glossa of the male and the smooth and largely horizontal propodeal triangle. It differs from *Palaeorhiza*, however, in the lack of a pre-occipital carina, in the short but clearly linear fovea of the second tergum, in the deep

constriction between the first and second metasomal terga, as well as in sternal and genital characters. The metasoma is wholly dark, the yellow being concentrated on the head and fore part of the thorax.

Mandibles bidentate; glossa of male about one-fourth as long as the head, pointed; inter-antennal distance greater than clypeo-ocular distance; subantennal sutures parallel below, directed outward above, considerably longer than diameter of antennal socket (about twice as long in male). Stigma moderate sized, more than two-thirds as long as costal edge of marginal cell; free part of marginal cell much longer than rest and longer than distance from apex of cell to wing tip, apex of cell bent a little away from wing margin; second submarginal cell more than half as long as first, receiving both recurrent veins; propodeal triangle smooth, largely subhorizontal as in *Palaeorhiza*, subhorizontal part of propodeal profile shorter than vertical part; ridge in front of middle coxa not very sharp. Posterior part of first tergum and base of second strongly constricted; second tergum with gradulus procurved, fovea short linear; seventh sternum of male with apical lobes broad, with hairs; eighth sternum of male with apex blunt, with short hairs.

DISTRIBUTION: Southern Queensland, New South Wales.

INCLUDED SPECIES

Hemirhiza hieroglyphica (Rayment, 1935) (*Palaeorhiza*) n. comb. (C.S.I.R.O.)
melliceps (Cockerell, 1918b) (*Palaeorhiza*) n. comb. (B.M.)

Hemirhiza hieroglyphica is a synonym of *melliceps*, so that the genus contains but one species.

AMPHYLAEUS, NEW GENUS

Plate 12, figures 5-8; text figures 378, 379,
474, 475, 500-504

TYPE: *Prosopis morosa* Smith, 1879.

This small genus consists of moderate-sized to large black species with limited yellow markings, including a yellow scutellum like that of many species of *Hylaeus*. The smaller species are not superficially distinguishable from those *Hylaeorhiza* and *Hylaeus* that exhibit such coloration. This is the only genus other than *Meroglossa* in which there

are small spines on the outer apical hind tibial margin; in *Amphylaeus* the spines are present only in the female, while in *Meroglossa* there are usually two spines (in some cases only one) present in both sexes. The procurved second tergal gradulus, linear foveae of the same tergum, as well as male sternal characters, further differentiate *Amphylaeus* from *Meroglossa*. From *Hylaeus* the genus is distinguished by the pointed glossa of the male as well as the characters listed.

Mandibles bidentate; *glossa of male short and broad, pointed; face of male with small smooth areas or deep depressions above antennae* (not above and below as in *Meroglossa*); *subantennal sutures of male arcuate outward*; interantennal distance greater than or equal to clypeo-ocular distance; subantennal suture about as long as diameter of antennal socket (not verifiable for male of *Amphylaeus, sensu stricto*, because of fusion of clypeus and supraclypeal area); *hind tibia of female only with two small spines on outer apical margin*; stigma more than half as long as costal margin of marginal cell, free part of cell slightly longer than or equal to rest of cell, slightly less than or equal to distance from apex of cell to wing tip; apex of marginal cell slightly away from costa; second submarginal cell two-thirds as long as first or a little less, receiving both recurrent veins; subdorsal surface of propodeum curving uninterruptedly onto vertical surface which is considerably larger than subdorsal surface as seen in profile. *Second tergum with fovea short linear; gradulus usually hidden*, slightly procurved; seventh sternum of male with both lobes broad and hairy, ventral one broadly emarginate; eighth sternum of male with apical process short, subtruncate, with hairs; gonocoxites broad, with subapical ventral lobe projecting mesad.

The nests of *A. sculptifrons*, in many ways similar to those of *Hylaeus*, were found in dead dry stems of *Xanthorrhoea* by Michener (1960c).

A nest of *A. nubilosellus mediostictus* was found in the pith of a dead broken stem of *Xanthorrhoea* near Beerwah, southern Queensland, by Mary H. Michener.

KEY TO THE SUBGENERA OF *Amphylaeus*

Male with clypeus and supraclypeal area indistin-

guishably fused, subantennal sutures and upper lateral parts of epistomal suture united as one strongly arcuate suture from tentorial pit to antennal base; female with interantennal distance equal to clypeo-ocular distance

. *Amphylaeus, sensu stricto*
Male with complete epistomal suture of ordinary form and joining subantennal sutures in usual way; female with interantennal distance nearly twice minimum clypeo-ocular distance
. *Agogenohylaeus*

The two subgenera are so different that they might have received generic rank; indeed the fact of their relationship is not evident without detailed study since the external characters that emphasize it are inconspicuous. The relationship is fully corroborated by the structures of the hidden sterna and genitalia. These structures are similar to one another to a degree totally unexpected in view of the external dissimilarity of the subgenera.

AGOGENOHYLAEUS, NEW SUBGENUS

Plate 12, figures 5, 6; text figures 378, 474, 500

TYPE: *Prosopis nubilosellus* Cockerell, 1910.

This subgenus contains moderate-sized species very like *Hylaeus* to which they are probably related.

Scape of male not swollen; male with mere smooth area on each side of face above antenna; clypeus separated from supraclypeal area; subantennal suture of female shorter than diameter of antennal socket; interantennal distance of female nearly twice minimum clypeo-ocular distance; malar space about one-third as long as broad.

DISTRIBUTION: Eastern Australia from Victoria to central Queensland.

INCLUDED SPECIES

Amphylaeus (Agogenohylaeus) arnoldi (Rayment, 1939) (*Hylaeus*) n. comb. (C.S.I.R.O.)

longmani (Cockerell, 1929d) (*Hylaeus*) n. comb. (Q.M.)

mediostictus (Cockerell, 1912a) (*Prosopis*) n. comb. (B.M.)

nubilosellus (Cockerell, 1910d) (*Prosopis*) n. comb. (B.M.)

sydneyensis (Friese, 1924) (*Prosopis*) n. comb. (desc.)

AMPHYLAEUS, NEW SUBGENUS

Plate 12, figures 7, 8; text figures 379, 475,
501-504

TYPE: *Prosopis morosa* Smith, 1879.

This subgenus consists of large species exhibiting the remarkable characters listed below: scape of male slightly swollen; male with deep depression in each side of face above antenna; *clypeus* and *supraclypeal area* of male *completely fused*, a continuous suture strongly arcuate outward extending from antennal base to tentorial pit; subantennal suture of female about as long as diameter of antennal socket; interantennal distance of female about equal to clypeo-ocular distance; malar space two-thirds as long as broad in female, as long as or longer than broad in male.

DISTRIBUTION: Victoria to southern Queensland.

INCLUDED SPECIES

- Amphylaeus* (*Amphylaeus*) *hardcastlei* (Rayment, 1939) (*Meroglossa*) n. comb. (C.S.I.R.O.)
morosus (Smith, 1879) (*Prosopis*) n. comb. (B.M.)
sculptifrons (Cockerell, 1921a) (*Prosopis*) n. comb. (B.M., mouthparts on slide U.S.N.M.)

GENUS MEROGLOSSA SMITH

Plate 12, figures 9-11; text figures 380, 476,
505-508

Meroglossa SMITH, 1853, p. 33. Type: *Meroglossa canaliculata* Smith, 1853 (monobasic).

Meroglossula PERKINS, 1912, p. 99. Type: *Meroglossa eucalypti* Cockerell, 1910 (monobasic).

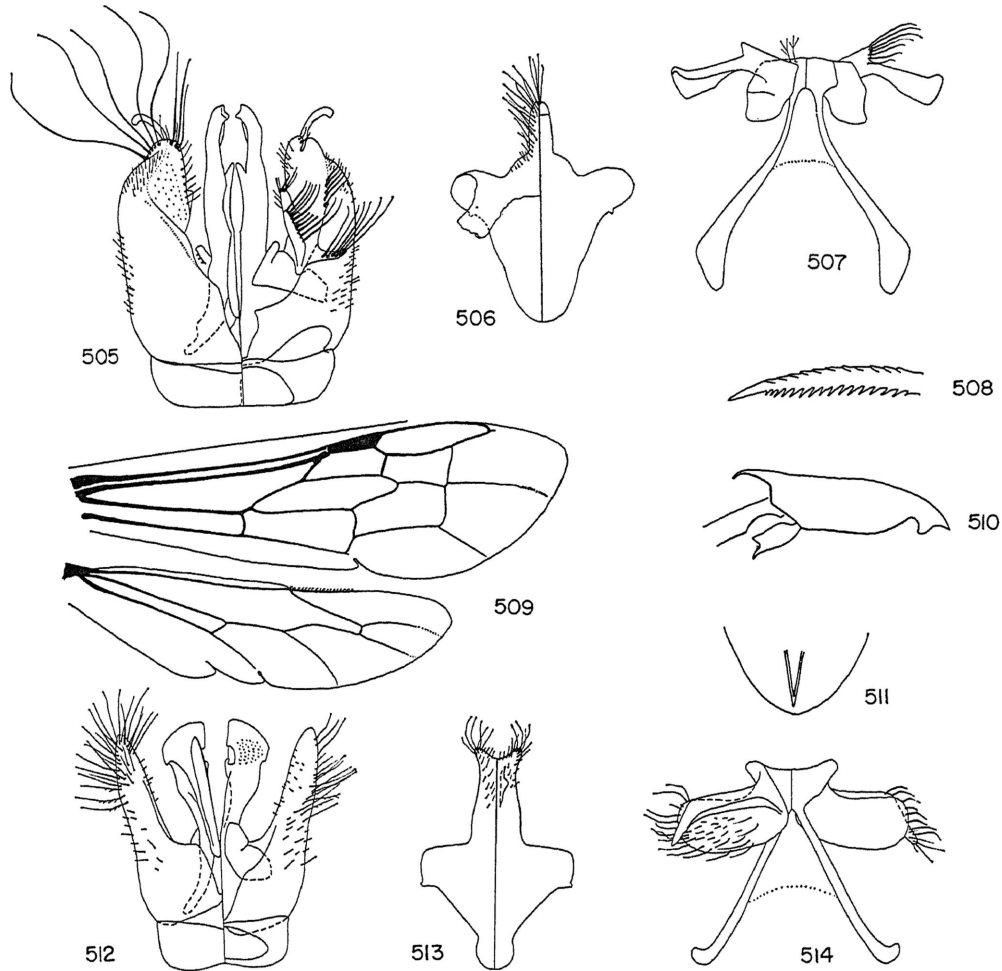
The bees of this genus are robust and of moderate to large size, reddish brown to black, with limited yellow or white markings.

Mandibles bidentate; *glossa* of male short, pointed; face of male with broad shining depression on each side extending from clypeus to level of ocelli, or occasionally not much above level of antennal bases, these depressions usually very deep and conspicuous; scape of male swollen; hind tibia with outer apical margin armed with one or usually two spines; stigma more than half (two-thirds in some small species) as long as costal margin of marginal cell, free part of cell subequal to rest or a little longer, subequal to or a little shorter than distance from end of cell to wing tip, apex of cell rounded away from wing

margin; second submarginal cell about as long as first to half as long as first, receiving both recurrent veins or the first interstitial; propodeum with basal horizontal zone much shorter than vertical portion and separated from it by an angle but usually not by a carina; ridge in front of mesocoxa inconspicuous. Second tergum with fovea absent or punctiform; *gradulus* broadly recurved medially, therefore usually exposed; seventh sternum of male with dorsoapical lobe fringed with long hairs (in *torrida* group) or partly so, ventroapical lobe hairless; eighth sternum of male with apical process long, blunt, hairy; gonocoxites with long bristles apically and a long apical process (absent from *torrida* group).

The genus *Meroglossa* seems sufficiently homogeneous that no subdivision is warranted. The ocelli are unusually large (so that the ocellocular distance is less than an ocellar diameter) in *ocellata*, they are only a little smaller in *canaliculata*, are still smaller in most other species, reaching a minimum in the female of *nigrifrons* in which the ocellocular distance is about two ocellar diameters. In most species the hind tibial spurs are briefly and finely pectinate, but they are more finely so in the small species such as *deceptor*, *eucalypti*, *torrida*, *sculptissima*, and *rubricata*; however, in the presumed female of another small form, *decipiens*, they are pectinate. They are even more finely toothed, and hence finely and closely "ciliate," in *itamuca*, *trigonoides*, *nigrifrons*, and, surprisingly, in the very large *ocellata*. The small species listed above have a rather uniform appearance (although the modifications of the face of the male differ among them) and might be regarded as a subgenus *Meroglossula*. They have in common the reduction of the outer apical hind tibial spines that characterize the genus. In other species of the genus there are two such spines on each hind tibia. In *torrida*, *trigonoides*, and *rubricata* there are two in the females but only one in the males (male *rubricata* and *trigonoides* not seen), while in *eucalypti* and *sculptissima* there is only one in each sex. In *deceptor* (male only seen), *chiropterina* (male only seen), and *decipiens* (presumed female only, male type having lost legs) there is only one spine.

Meroglossa miranda is here transferred to



FIGS. 505-514. Hylaeinae. 505-507. Male genitalia and eighth and seventh sterna of *Meroglossa canaliculata*. 508. Inner hind tibial spur of female of same. 509, 510. Wings and fore tibia of male of *Hyleoides concinna*. 511. Sixth tergum of female of *H. waterhousei*. 512-514. Male genitalia and eighth and seventh sterna of *H. concinna*.

Hylaeus (*Pseudhylaeus*); and *M. kelvini*, to *Hylaeus* (*Xenohylaeus*).

Nests of *M. torrida* in burrows of beetles in dead dry twigs were described by Michener (1960c). The cells are similar to those of *Hylaeus*.

DISTRIBUTION: Australia, most abundant in the north and reaching northern Queensland, Darwin, and northwest Australia.

INCLUDED SPECIES

Meroglossa canaliculata Smith, 1853 (B.M.)
chiropterina Cockerell, 1930a (M.C.Z.)
decepiens Perkins, 1912 (B.M.)
deceptor Perkins, 1912 (B.M.)

desponsa (Smith, 1853) (*Prosopis*) (B.M.)
disjuncta (Friese, 1924) (*Prosopis*) (desc.). Pre-occupied by *Prosopis disjuncta* Cockerell, 1905; not renamed because stated by Cockerell to be a synonym of *eucalypti*
diversipuncta (Cockerell, 1909b) (*Prosopis*)
eucalypti Cockerell, 1910c (B.M.)
hilli Cockerell, 1929a (A.M.N.H.)
impressifrons (Smith, 1853) (*Prosopis*) (B.M.)
itamuca (Cockerell, 1910d) (*Prosopis*) n. comb. (B.M.)
kershawi Cockerell, 1913a (U.S.N.M.)
nigrifrons (Smith, 1853) (*Prosopis*) (B.M.)
ocellata Michener, new species (C.S.I.R.O.)
penetrata (Smith, 1879) (*Prosopis*) (B.M.)
percrassa (Cockerell, 1905e) (*Prosopis*) (B.M.)

persulcata Cockerell, 1912a (C.S.I.R.O.)
punctata Rayment, 1935 (C.S.I.R.O.)
rubricata (Smith, 1879) (*Prosopis*) (B.M.)
sculptissima Cockerell, 1910c (B.M.)
soror Perkins, 1912 (B.M.)
striaticeps (Fries, 1924) (*Prosopis*) (desc.)
sulcifrons (Smith, 1853) (*Prosopis*) (B.M.)
sydneyana Rayment, 1935 (C.S.I.R.O.)
torrida (Smith, 1879) (*Prosopis*) (B.M.)
triangulata Rayment, 1939 (C.S.I.R.O.)
trigonoides Rayment, 1935 (C.S.I.R.O.)
tuberculata Rayment, 1939 (C.S.I.R.O.)

GENUS HYLEOIDES SMITH

Plate 12, figure 12; plate 13, figure 1; text
 figures 381, 469, 509-514

Hyleoides SMITH, 1853, p. 32. Type: *Vespa concinna* Fabricius, 1775 (designation of Taschenberg, 1883, p. 45).

This is the most unusual and distinctive genus of the hylaeine bees. The species are large, with red or yellow integumental markings on the metasoma and with the forewings infuscated along their costal margins so that the general aspect is that of certain wasps.

Mandibles bidentate, in some females tridentate; *glossa* large, deeply bifid; interantennal distance greater than clypeo-ocular distance; clypeus separated from antennae by distance equal to or less than diameter of antennal socket. *Anterior tibial spine enormous, curved*; stigma rather small, half as long as costal part of marginal cell or less, *margin in marginal cell short and straight; free part of marginal cell much shorter than rest and much shorter than distance from apex of cell to wing tip*; apex of marginal cell bent away from wing margin; second submarginal cell more than two-thirds as long as first, *distal side much longer than basal side*, receiving first recurrent vein near basal third. Propodeum with short horizontal surface separated by rounded or sharp angle from long vertical surface, triangle therefore largely vertical; ridge in front of mesocoxa inconspicuous. *First tergum with longitudinal median groove basally*; second tergum without fovea, gradually transverse, *spiracle fully exposed because of angulate margin of first tergum*; *apex of first sternum broadly concave*, not notched or slit medially as in other genera; *second sternum protuberant basally*; seventh sternum of male with hairs on both lobes, dorsal lobe slender;

eighth sternum of male with apex notched and hairy; penis valves little downcurved, with inner preapical notch and process.

The presence of a pygidial plate is most unusual among the Hylaeinae. Five species, marked *a* in the list below, have distinct pygidial plates in the females. The others, marked *b*, lack such plates. Two species of *Euprosopoides* and one of *Prosopistemon* (subgenera of *Hylaeus*) exhibit plates even larger than those of *Hyleoides*.

The nests of *Hyleoides*, in hollow stems, have been described by Rayment (1961b).

DISTRIBUTION: Australia, north to northern Queensland; also Lord Howe Island.

A single slender, not very fully marked individual of *H. zonalis* from Lord Howe Island in the collection of the Commonwealth Scientific and Industrial Research Organization raises the question of whether the species is a native there. Although recorded from New South Wales (Hunter River) and known from Queensland (female in the United States National Museum), *zonalis* is common only in Western Australia. It therefore seems unlikely to have reached Lord Howe Island, about 300 miles off the east coast of Australia, by itself. The rather distinctive appearance of the bee, however, suggests that it may represent a population different from that of the mainland.

INCLUDED SPECIES

- Hyleoides* (b) *albocincta* Cockerell, 1909a (B.M.)
 (a) *bivulnerata* Cockerell, 1921 (B.M.)
 (b) *collaris* Friese, 1924 (desc.)
 (b) *concinna* (Fabricius, 1775) (*Vespa*) (B.M.)
 (a) *concinna* Cockerell, 1909a (B.M.)
 (b) *ruficollaris* Rayment, 1935 (desc.).¹ Name attributed to Friese, doubtless an error for *collaris*
 (a) *rufocincta* Cockerell, 1909a (B.M.)
 (a) *striatula* Cockerell, 1921 (Q.M.)
 (a) *waterhousei* Cockerell, 1913e (B.M.)
 (b) *zonalis* Smith, 1853 (B.M.)

FAMILY HALICTIDAE

This is one of the largest families of bees, easily recognized by the long, basally tapering, prepupal parts of the galeae and by the

¹ The supposed difference in genitalia between this and *concinna* shown in Rayment's figures is based merely on whether the eighth sternum happened to stick to the genital capsule or not.

absence or feeble sclerotization of the mentum and submentum. All forms in our area have three submarginal cells. The basal vein of the forewing is usually strongly curved, unlike that of most members of related families.

KEY TO THE SUBFAMILIES OF THE HALICTIDAE
OF THE AUSTRALIAN REGION

- Pre-episternal groove absent or inconspicuous below scrobal groove; first and third submarginal cells subequal in length, contrasting with much shorter second submarginal cell; prepygidial fimbria of female present and undivided Nomiinae
- Pre-episternal groove continuing below scrobal groove; third submarginal cell shorter than first, often not much longer than second; prepygidial fimbria of female usually divided by longitudinal median line, furrow, or area, surrounded by hairs Halictinae

SUBFAMILY NOMIINAE

This subfamily of bees is abundant in the southern and tropical parts of the Old World, including Australia, is relatively poorly represented in the Holarctic Region, and is absent from South America. For reasons of tradition and lack of study of African and Asiatic species, the Nomiinae are not subdivided into many genera, most of the species being retained in the genus *Nomia*.

GENUS *NOMIA* LATREILLE

Plate 13, figures 2-9; text figures 515-563

Nomia LATREILLE, 1804, p. 182. Type: *Andrena curvipes* Fabricius, 1781 (monobasic).

The genus *Nomia*, found in all continents except South America, is relatively scarce in the Holarctic Region but is richly represented throughout the Paleotropical area as well as in Australia and South Africa. I suspect that it will ultimately be practical to recognize several genera in this group. For example, *Nomia*, *sensu stricto*, *Curvinomia*, *Acunomia*, and *Hoplonomia* may be found to constitute a single definable genus. *Rhopalomelissa* will probably also be a separate genus. *Stegano-*
mus, perhaps with a large subgenus *Pseudapis*, may constitute another genus. In an excellent paper, Hirashima (1961) has already separated several Japanese groups at the generic level. I prefer not to take this step

for the Australian fauna, however, until the Asiatic and African faunas can be adequately studied, since groups that appear discrete in one area may be found to merge in another.

As is pointed out in detail below, some of the subgenera discussed are artificial or may require new names.

The bees of this genus excavate their nests in the soil. Like those of the Halictinae, the cells may be either scattered or in dense clusters, and in the latter case may be surrounded by an air space as in some halictids. Rayment (1956c) has described such nests for *N. australis*, and Michener (1964a) has described the quite different nests of *N. pulchribalteata*.

KEY TO THE SUBGENERA OF *Nomia* OF THE
AUSTRALIAN REGION

1. Malar space large 2
- Malar space absent or nearly so 3
2. Metanotum usually with median tubercle or projection; mandible of female tridentate; inner hind tibial spur of female pectinate *Mellitidia*
- Metanotum biconvex, without median tubercle or projection; mandible of female bidentate; inner hind tibial spur of female serrate, not pectinate *Ptilonomia*
3. Tegulae enormous, especially broad posteriorly; pronotal lobes anteriorly lamellate, the lamellae forming dorsolateral angles of pronotum and medially connected across thorax by carina across front part of scutum *Pseudapis*
- Tegulae of ordinary size and shape (enlarged in *flavoviridis* group of *Austronomia*); pronotal lobes not lamellate, no carina across front part of scutum 4
4. Body largely testaceous; ocellular distance less than or equal to ocellar diameter; basitibial plate of female very slender, much narrower than base of tibia, apex very acute *Reepenia*
- Body not testaceous, head and thorax black, in some cases greenish or bluish; ocellular distance more than ocellar diameter; basitibial plate of female broad or incompletely defined, apex not very acute 5
5. Pronotum with transverse subapical lamella (notched medially in some extralimital forms); basitibial plate of female defined only posteriorly; inner hind tibial spur with submedian expansion or lobe beyond which margin may be serrate . . . *Rhopalomelissa*
- Pronotum without lamella; basitibial plate complete; inner hind tibial spur uniformly serrate, rarely pectinate 6

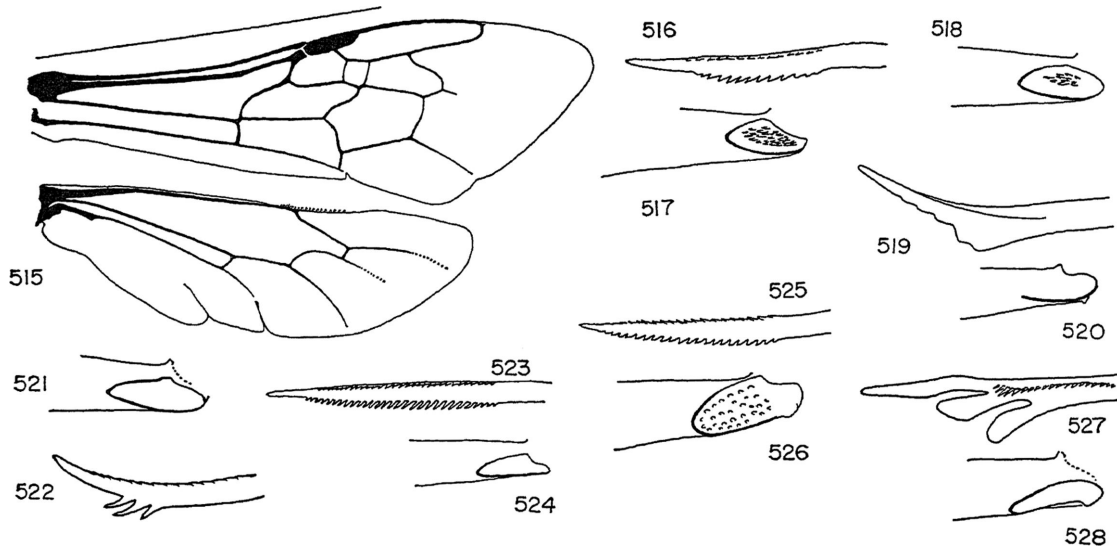


FIG. 515. Nomiinae. Wings of *Nomia* (*Austronomia*) *australica*.

FIGS. 516-528. Inner hind tibial spurs of females and basitibial plates of females of Nomiinae. 516, 517. *Nomia* (*Austronomia*) *australica*. 518. *N.* (*Curvinomia*) *aurantifera*. 519, 520. *N.* (*Rhopalomesella*) *halictella*. 521. *N.* (*Ptilonomia*) *plumosa*. 522. *N.* (*Austronomia*) *maai*. 523, 524. *N.* (*Reepenia*) *bituberculata*. 525, 526. *N.* (*Hoplonomia*) *lyonsiae*. 527, 528. *N.* (*Mellitidia*) *gressitti*.

6. Metasomal terga without integumental color bands but with subapical bands of pale hair in most species; basitibial plate of female angulate apically; inner hind tibial spur commonly laterally curved and often somewhat expanded medially . . . *Austronomia*
Metasomal terga with apical integumental bands of enamel-like blue, green, yellow, or rarely white and without hair bands (bands of color absent from certain forms from the Moluccas and Kai); basitibial plate of female rounded apically; inner hind tibial spur not broadened or curved medially . . . 7
7. Metanotum with large bifid projection or with two projections; scutellum in some cases with a pair of smaller projections; propodeum entirely vertical as seen in profile . . . *Hoplonomia*
Metanotum and scutellum normal; propodeum with basal area defined and sloping, in contrast to remainder of surface which is vertical as seen in profile . . . *Curvinomia*

Nomia NOT PLACED IN THE PRESENT CLASSIFICATION

caerulescens Friese, 1909 (desc.) New Guinea

Nomia chalybea Friese (1909) is a species of *Leioproctus*, *sensu stricto*. *Nomia flavopunctata* Friese (1924) appears to be a *Lasioglossum* of the subgenus *Parasphcodes*. *Nomia lorentzi*

Friese (1911b) is a *Homalictus* according to M. A. Lieftinck who has examined the type.

SUBGENUS CURVINOMIA MICHENER

Text figures 518, 544-547

Paranomina FRIESE, 1897a (not Conrad, 1860), p. 48. Type: *Nomia chalybeata* Smith, 1875 (designation of Cockerell, 1910 I, p. 290).

Paranomina MICHENER, 1944 (not Hendel, 1907), p. 251, new name for *Paranomina* Friese. Type: *Nomia chalybeata* Smith, 1875 (autobasic and original designation).

Curvinomia MICHENER, 1944, p. 251. Type: *Nomia californiensis* Michener, 1937 = *Nomia tetrazonata* Cockerell, 1910 (monotypic and original designation).

This subgenus is closely allied to *Nomia*, *sensu stricto*, from which it differs by having the basitibial plate of the female complete (it is not defined anteriorly in *Nomia*, *sensu stricto*); the propodeal enclosure is like that of *Austronomia*. It is quite possible that *Curvinomia* should be merged with *Nomia* proper. The Australian species are not closely related to American representatives of the group. The latter show, by their genitalia and hidden sterna, a close relationship to the American *Acunomia*, while the Australian

species are very different. Studies of the Asiatic species will be necessary to clarify the placement of our species.

Comb of hairs along rear margin of front basitarsus of female distinct; metanotum unmodified; propodeum with slanting basal area, delimited; basitibial plate of female rather broad, rounded apically; inner hind tibial spur of female finely serrate with close, rather long teeth. Metasomal terga with apical green, bluish, yellowish, occasionally reddish or white integumental bands that resemble enamel and without hair bands.

In some species (e.g., *aurantifer*) but not others, the middle tibial spur of the female is attenuated distally with large, widely separated teeth on each side.

DISTRIBUTION: This subgenus has rather few species but is widespread, from North America south to Cuba and Mexico, China, Taiwan, Philippine Islands, India, Ceylon, Africa, Indonesia, Queensland (northern to southern), Northern Territory.

INCLUDED SPECIES

- Nomia* (*Curvinomia*) *aurantifer* Cockerell, 1910b (B.M.)
fulvata (Fabricius, 1804)¹ (*Megilla*) Ambon
iridescent Smith, 1853 (B.M.) India (to southern Moluccas according to Lieftinck)
luteofasciata Friese, 1917 (desc.)
opulenta Smith, 1864 (Ox.) Morotai
quadridentata Smith, 1875a (B.M.*) Morotai
swainsoniae Cockerell, 1921 (Q.M.)

The following other species from the Eastern Hemisphere have been studied by me: *albofasciata* Smith (Sumatra); *tuberculifrons* Cockerell, *borneana* Cameron (Borneo); *elegans* Smith, *formosa* Smith (Celebes); *penangensis* Cockerell, *ridleyi* Cockerell, *subpurpurea* Cockerell (Malaya); *chalybeata* Smith (China); *megasoma* Cockerell (Taiwan); *mimosae* Cockerell, *longitarsis* Cockerell, *lusoria* Cockerell (Philippine Islands); *viridicincta* Meade-Waldo (Africa).

The closely allied subgenus *Nomia*, *sensu stricto*, occurs from Taiwan to India and Madagascar; the following species belong to it: *curvipes* (Fabricius), *eburneifera* Cockerell

(India); *viridilimbata* Saussure (Madagascar).

Dr. M. A. Lieftinck writes: "In the Indo-Australian region the units *Hoplonomia*, *Curvinomia* and *Nomia*, *sensu stricto*, all seem to merge into each other. All intergradations seem to occur in respect to the position, armature and amount of slanting of the thoracic parts and propodeum." In view of this statement, the groups here called *Curvinomia* and *Hoplonomia* become synonyms of *Nomia* proper. I have not taken this step at this time, since I have not studied all the pertinent material and since *Hoplonomia* has traditionally received subgeneric rank.

SUBGENUS HOPLONOMIA ASHMEAD

Text figures 525, 526, 529-533

Hoplonomia ASHMEAD, 1904, p. 4. Type: *Hoplonomia quadrifasciata* Ashmead, 1904 (designation of Cockerell, 1910 l, p. 289).

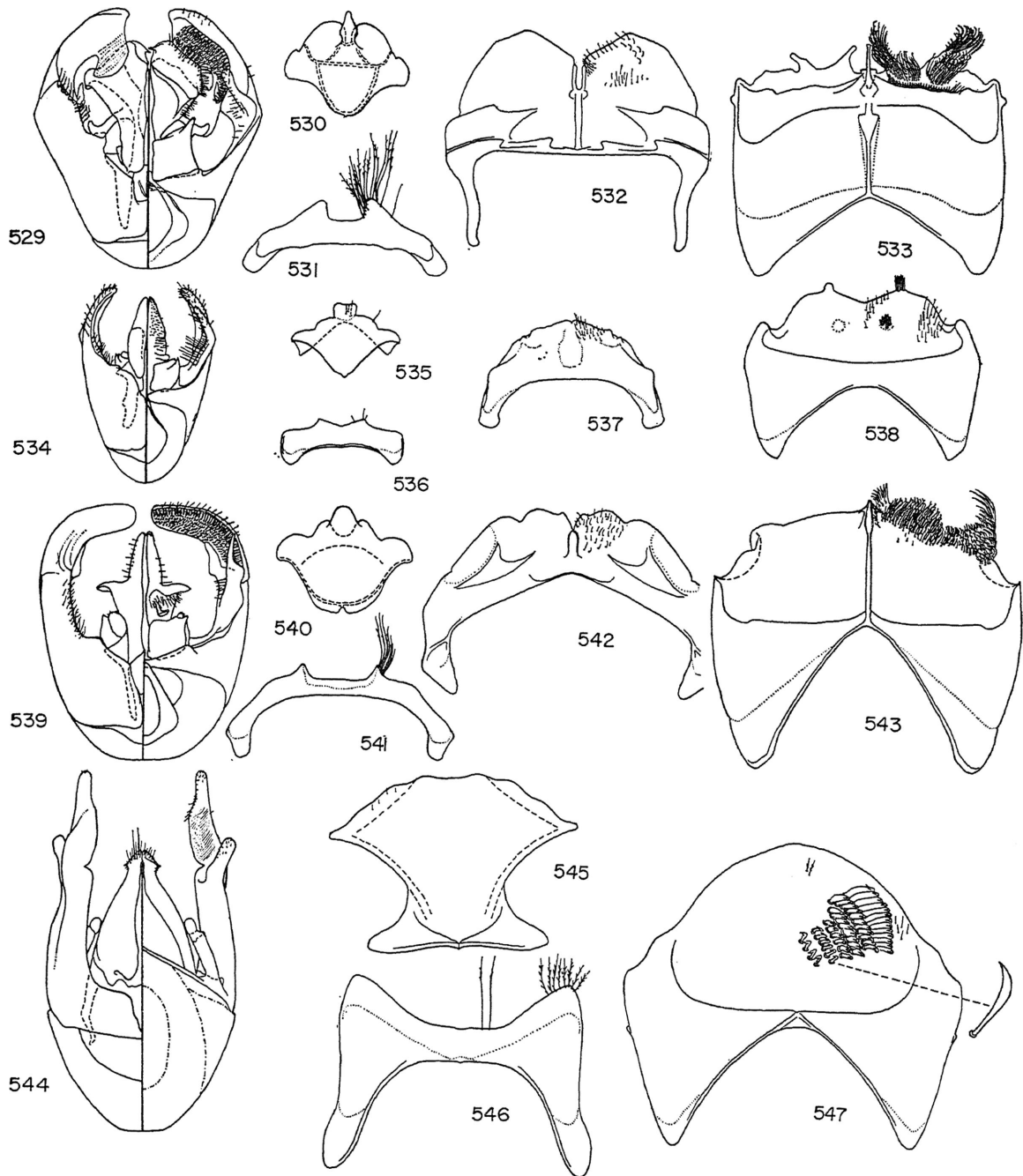
Like its close relative, *Curvinomia*, this subgenus is characterized by enamel-like bands on the metasomal terga in almost all species. It differs by the characters italicized below.

Comb of hairs along rear margin of front basitarsus of female distinct; *metanotum with large bifid projection or pair of projections*; scutellum, especially in males, in some cases also with smaller projections; *propodeum entirely subvertical seen in profile, area not defined medially* although evident laterally; basitibial plate of female large, rounded apically; inner hind tibial spur of female finely serrate as in *Curvinomia*; metasomal terga usually with apical bands of enamel-like color, green, blue, yellow, or orange, and without bands of hair.

Nomia flavipennis Friese and *amboinensis* Cockerell are obvious members of this group, agreeing with *N. ellioti* in the median and lateral longitudinal clypeal carinae and other details of structure in addition to the metanotal process. Yet they completely lack the metasomal bands, the metasoma being shining black.

DISTRIBUTION: Madagascar, India, China, Taiwan, Philippine Islands, Indonesia, New Guinea, Bismarck Archipelago, Solomon Islands, Queensland (to south border), Northern Territory.

¹ According to Lieftinck (*in litt.*) this is the *strigata* of authors, but the true *strigata* is a *Hoplonomia*.



FIGS. 529-547. Male genitalia and eighth, seventh, sixth, and fifth sterna of males of *Nomiinae*. 529-533. *Nomia (Hoplonomia) lyonsiae*. 534-538. *N. (Rhopalomelissa) halictella*. 539-543. *N. (Austro-nomia) australica*. 544-547. *N. (Curvinomia) aurantiifer* (fifth sternum unmodified and omitted).

INCLUDED SPECIES

- Nomia* (*Hoplonomia*) *amboinensis* Cockerell, 1907a (A.M.N.H.) Ambon
austrorogans Cockerell, 1905g (B.M.)
darwinorum Cockerell, 1910b (B.M.)
elliotti Smith, 1875b (Ox.) India; reported from New Guinea and elsewhere
flavipennis Friese, 1909 ("typus" W.) Kai
froggatti Cockerell, 1911b (B.M.) Solomon Islands
lyonsiae Cockerell, 1912d (type series, Q.M.)
papuana Cockerell, 1929c (A.M.) New Guinea
pulchribalteata Cameron, 1901 (B.M.) New Britain
rubroviridis Cockerell, 1905g (B.M.)
strigata (Fabricius, 1793) (*Andrena*) India, Indonesia, recorded from Kai

Species from outside our area include the following: *punctulata* Dalla Torre (China); *quadrifasciata* (Ashmead) and others (Philippine Islands); *incerta* Gribodo, *tridentata* Smith, *pulchra* Friese, *parvula* Friese, *rhododonta* Cockerell (Indonesia); *callichlora* Cockerell, *westwoodi* Gribodo (India); *cuneata* Saussure (Madagascar).

AUSTRONOMIA, NEW SUBGENUS

Plate 13, figure 2; text figures 515-517, 522, 539-543

TYPE: *Nomia australica* Smith, 1875.

This subgenus contains the ordinary, dull-colored (in some cases greenish or bluish) *Nomia* species that are common in Australia. They usually have apical or subapical bands of hair on the terga, a feature shared, among our subgenera, with *Rhopalomelissa*, which, however, is very different because of its pronotal lamella and other characters indicated in the key.

Comb of hairs along rear margin of front basitarsus of female distinct to absent, usually evident but weak; metanotum simple, propodeum with basal area defined posteriorly (except in *maai*), subhorizontal to slanting, not vertical like rest of propodeal profile, in some cases very narrow, in others (*grisella*, *stalkerii*) incompletely delimited medially and nearly vertical; basitibial plate of female rather broad, apex angulate; inner hind tibial spur bent to one side submedially, finely to coarsely serrate (*ferricauda* has only four or five teeth; *maai* has only two or three long teeth so that spur is pectinate). Meta-

somal terga without color bands, usually with apical or subapical hair bands.

DISTRIBUTION: Australia, New Guinea, New Britain, Solomon Islands, Loyalty Islands, New Caledonia, a few species reaching Indonesia, the Philippines, Taiwan, and India. It possibly also reaches Japan. Not recorded from Tasmania, although present in Victoria.

INCLUDED SPECIES

- Nomia* (*Austronomia*) *adelaidella* Cockerell, 1910i (Berlin*)
aenea Smith, 1875a (B.M.)
aenescens Friese, 1912a New Guinea
aerata Smith, 1875a (B.M.)
alboscopacea Friese, 1917
analisis Friese, 1924 (desc.)
argentifrons Smith, 1862a (cotype B.M.)
australica Smith, 1875a (B.M.) = *australiaca* Dalla Torre, 1896 (unnecessary emendation)
babindensis Cockerell, 1930a (M.C.Z.)
brisbanensis Cockerell, 1913i (Q.M.)
cheesmanae Michener, new name for *N. nuda* Cheesman, 1953, Ann. Mag. Nat. Hist., ser. 12, vol. 6, p. 715, not *N. australica nuda* Rayment, 1939 (B.M.) Loyalty Islands
cyanella Cockerell, 1913i (B.M.)
dentiventris Smith, 1875a (B.M.)
dimissa Cockerell, 1921 (Q.M.)
doddi Cockerell, 1905g (B.M.)
erimae Friese, 1909 New Guinea
excellens Cockerell, 1929c; not Friese, 1930; not Cockerell, 1931 (A.M.)
ferricauda Cockerell, 1913i (Q.M.)
flavoviridis Cockerell, 1905g (B.M.)
fortior Cockerell, 1929c (A.M.)
frenchi Cockerell, 1912e (U.S.N.M.)
fulvoanalis Friese, 1924 (desc.)
generosa Smith, 1875a (B.M.)
geophila Cockerell, 1930b (Q.M.)
gilberti Cockerell, 1905d (B.M.)
gracilipes Smith, 1875a (B.M.) = *haemorrhoidalis* Westwood, 1875
grisella Cockerell, 1913i (B.M.)
hippophila Cockerell, 1910i (Berlin*)
hypodonta Cockerell, 1905g (B.M.)
kurandina Cockerell, 1910a (B.M.)
latetibialis Friese, 1924
latitarsis Friese, 1924 (desc.)
latiuscula Friese, 1924 (desc.)
maai Michener, new species (Bishop) New Guinea
macularis Friese, 1924 (desc.)
melanodonta Cockerell, 1926b (N.M.V.)
melanoptera Cockerell, 1910a (B.M.)
melvillianae Cockerell, 1929a (A.M.N.H.)

miranda Rayment, 1954a (C.S.I.R.O.)
moerens Smith, 1875a (B.M.)
muscosa Cockerell, 1910a (B.M.)
musgravei Cockerell, 1929c (A.M.)
nana Smith, 1875a (B.M.)
nuda Rayment, 1939 (desc.)
pennata Friese, 1924 (desc.)
phanerura Cockerell, 1913i (U.S.N.M.)
purnongensis Cockerell, 1913i (U.S.N.M.)
reginae Cockerell, 1905g (B.M.)
regis Cockerell, 1910a (B.M.)
rubra Rayment, 1931 (desc.). Preoccupied by Friese, 1904, but the form does not seem worth renaming
rufocognita Cockerell, 1905g (B.M.)
satelles Cockerell, 1912e (U.S.N.M.)
semiaurea Cockerell, 1905d (B.M.)
semipallida Cockerell, 1905g (B.M.)
sicheli Vachal, 1897a New Caledonia
smithella Gribodo, 1894=*ruficornis* Smith, 1875a; not Spinola, 1838 (B.M.)
stalker Cockerell, 1910a (B.M.)
subaustralica Cockerell, 1910i (Berlin*)
submoerens Cockerell, 1914m (B.M.)
tenuihirta Cockerell, 1905g (B.M.)
testaceipes Friese, 1924 (desc.)
thor Cockerell, 1930e (desc.)
turneri Friese, 1924 (desc.)
ulongensis Cockerell, 1929c (A.M.)
victoriae Cockerell, 1910i (Berlin*)
willei Cameron, 1905=*gazellae* Friese, 1909=*metallica* Cameron, 1901, not Smith, 1863 (B.M.) New Britain
wilmattae Cockerell, 1929g (U.S.N.M.) New Caledonia

Species from outside our area which belong to this subgenus are *clypeata* Smith, *aurata* Bingham, *pilipes* Smith, *perlucida* Cockerell, and probably the large species *antennata* Smith, which has the last antennal segment of the male expanded as in *Steganomus* (India); *kankauana* Strand (Taiwan); and *philippinensis* Friese (Philippine Islands). It is very probable that *fruhstorferi* Pérez from Japan belongs to this subgenus (for characters, see Hirashima, 1961).

This subgenus is composite, at least to the extent that *N. semiaurea* should be placed in a separate subgenus, as shown by the unmodified hind legs of the male and the distinctive genitalia and hidden sterna. Further study will be necessary to find associated characters of females and to determine which of the above species, many of them known only from females, should be placed with *semiaurea*.

SUBGENUS PSEUDAPIS W. F. KIRBY

Pseudapis W. F. Kirby, 1900, p. 15. Type: *Pseudapis anomala* W. F. Kirby, 1900 (monobasic).

Nomiapis COCKERELL, 1919d, p. 208. Type: *Nomia diversipes* Latreille, 1806 (monobasic and original designation).

This subgenus, consisting of small, robust species, is immediately recognizable by the enormous tegulae, a character shared only by *Steganomus* which lacks the carina across the front of the scutum. Probably it is recorded from Australia by error, as explained below.

Thoracic and tegular structures as described in key; metanotum normal; propodeum with narrow, basal, horizontal zone; basitibial plate of female broad and rounded; inner hind tibial spur of female finely serrate. Metasoma without colored bands.

DISTRIBUTION: Southern Europe to South Africa (very numerous African species), eastward through Asia to India, Thailand, China, and Japan. The only "Australian" record is based on an old specimen in the British Museum labeled "Sydney." The related subgenus *Steganomus* approaches our area as closely as Java.

INCLUDED SPECIES

Nomia (Pseudapis) lepidota Cockerell, 1905g (B.M.). Probably erroneously recorded from the Australian fauna

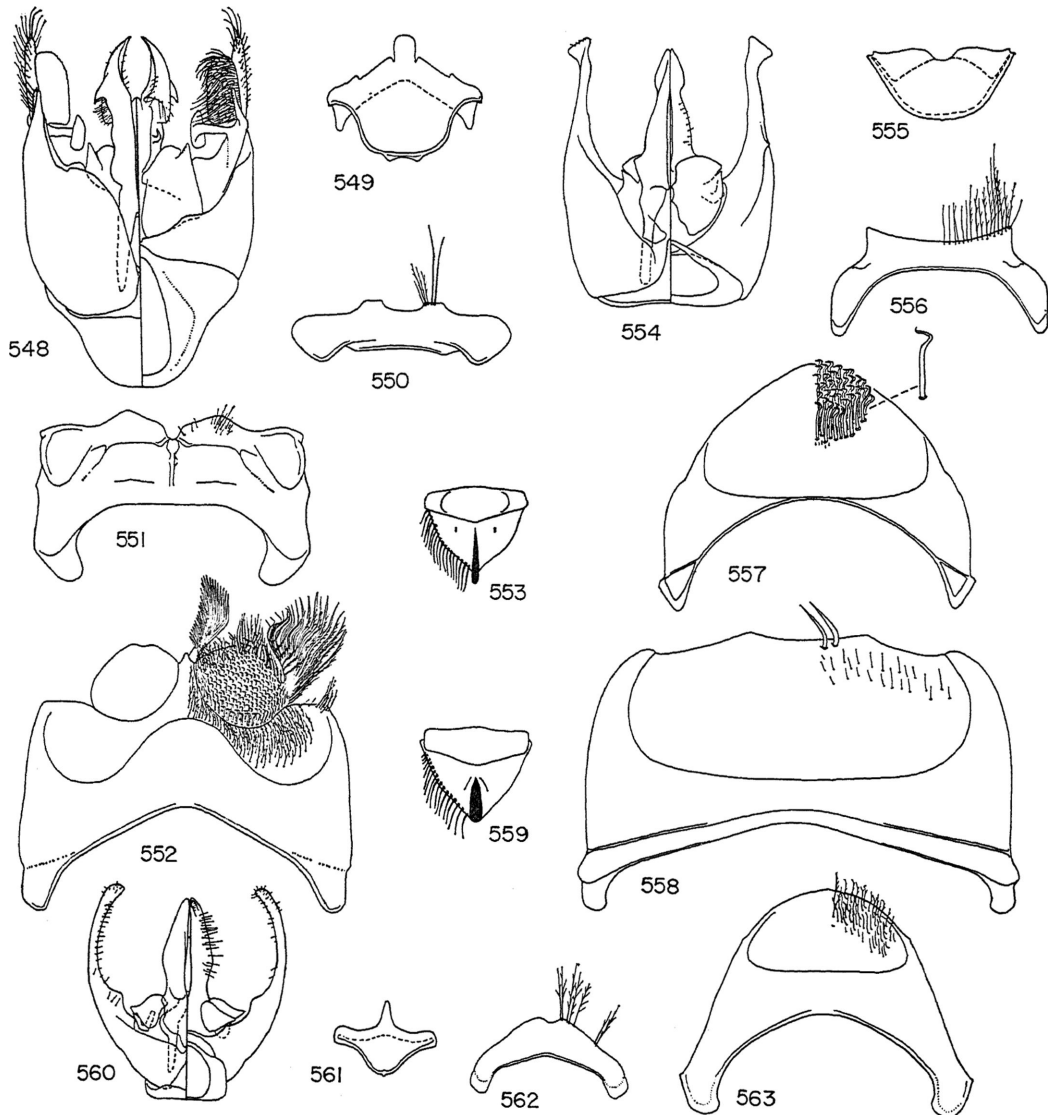
The subgeneric synonymy shown above was indicated by Michener (1961b).

SUBGENUS RHOPALOMELISSA ALFKEN

Text figures 519, 520, 534-538

Rhopalomelissa ALFKEN, 1926, p. 267. Type: *Rhopalomelissa xanthogaster* Alfken, 1926 (designation of Sandhouse, 1943, p. 596).

This subgenus, the relation of which to *Nomia* was first shown by Michener (1961b), consists of slender species with the metasoma of the male often unusually slender basally so that it appears almost petiolate or clavate. The metasomal terga (in Indo-Australian species but not in some African ones) have apical hair bands like those of most *Austro-nomia* and the Nearctic *Epinomia*, but *Rhopalomelissa* differs from those groups by the collar-like pronotal lamella, the incomplete basitibial plate of the female, the



FIGS. 548-563. Nomiinae. 548-553. Male genitalia and eighth, seventh, sixth, and fifth sterna of male, and labrum of female of *Nomia* (*Mellitidia*) *gressitti*. 554-559. Same of *Nomia* (*Ptilonomia*) *plumosa*. 560-563. Male genitalia and eighth, seventh, and sixth sterna of male *Nomia* (*Reepenia*) *bituberculata*.

medially expanded inner hind tibial spur of the female, and other characters. An unusual feature of *Rhopalomelissa* is the short glossa, much shorter than the head and not exceeding the maxillary palpi. *Rhopalomelissa* was described as a distinct genus; it is not more distinctive than certain other groups of *Nomia*, especially when the more robust species of Africa and Asia are seen.

Pronotum with transverse lamella (in some extralimital species notched medially, in ours continuous); comb of hairs on front basitarsus of female absent; metanotum unmodified; propodeum rounded or declivous, basal area not clearly defined; *basitibial plate of female defined only posteriorly*, not otherwise evident; *inner hind tibial spur of female expanded medially*, in Australian forms with

expansion taking the form of a large lobe, margin beyond expansion and of expansion itself with or without inconspicuous teeth. Metasoma without color bands, apices of terga (except in many African species) with bands of hair.

DISTRIBUTION: Africa, India, Ceylon, eastward to Taiwan and the Philippine Islands, Indonesia, New Guinea, Solomon Islands, Australia south to southern Queensland.

INCLUDED SPECIES

- Nomia* (*Rhopalomelissa*) *clavata* Smith, 1862b (Ox.) Halmahera. Preoccupied by *Halictus clavatus* Smith, 1853, which is a *Nomia*; not renamed because it is probably the male of *modesta*
halictella Cockerell, 1905d (not Strand, 1912) (B.M.)
minutula Friese, 1909 ("typus" W.) New Guinea
modesta Smith, 1862b (Ox.) Halmahera
pseudoceratina Cockerell, 1910a (B.M.)
triangularis Cockerell, 1905d (B.M.)
williamsi Cockerell, 1930a (M.C.Z.)
xanthogastra (Alfken, 1926) (*Rhopalomelissa*) (desc.) Buru

Among the numerous African species, the following may be mentioned as belonging here: *rubella* Smith, *fausta* (Smith), *notabilis* Schletterer, *basutorum* Cockerell, and *patellifera* Westwood. Authentic material of the following non-African species has been examined: *basipicta* Wickwar, *carinicolis* Cameron, *comberi* Cockerell (Ceylon); *andrennina* Cockerell, *fulvinerva* Cameron, *abuensis* Cameron, *aurifrons* Smith, *aureohirta* Cameron, *kangrae* Nurse, *floralis* Smith, *phenacura* Cockerell (India); *morata* Cockerell (Malaya); *burmica* Cockerell (Burma); *ceratina* (Smith), *bicarinata* Cameron (Indonesia); *elongata* Cockerell, *levicauda* Cockerell, *elongatula* Cockerell, *lautula* Cockerell, *palavanica* Cockerell (Philippine Islands); and *mediorufa* (Taiwan).

SUBGENUS REEPENIA FRIESE

Plate 13, figures 8, 9; text figures 523, 524, 560-563

Reepenina FRIESE, 1909, p. 205. Type: *Nomia variabilis* Friese, 1909, by present designation. Sandhouse's (1943) statement that *Reepenina* is monobasic is not strictly correct, since Friese named several "varieties" of *variabilis*, all in-

cluded, according to some points of view, among the names available for type selection. A proposal has been made to place *Reepenina*, with type *variabilis*, on official lists for zoological nomenclature (Michener and Moure, 1964).

Megaloptodes MOURE, 1958, p. 183. Type: *Megalopta bituberculata* Smith, 1853 (monobasic and original designation).

The name *Megalopta* Smith, 1853, was based on two supposedly South American species, *bituberculata* Smith, 1853, and *idalia* Smith, 1853. The former is a nomiine bee (*Reepenina*); the latter is a member of a halictine genus well known in the Neotropical Region under the name *Megalopta*. Unfortunately, Cockerell (1900) designated *M. bituberculata* as the type species. *Megalopta bituberculata* was erroneously attributed to South America, as an examination of the type specimen in the British Museum shows; it must actually have come from Australia. Acceptance of Cockerell's type designation would result in transfer of the name *Megalopta* from a Neotropical to an Australian group of bees and changes in the names of both groups.

Moure (1958) argued that, because most of the characters cited in the original description of *Megalopta* were based on *M. idalia*, that form and not *M. bituberculata* should be the type species of the genus, in accordance with the designation of *idalia* as type of *Megalopta* by Ducke (1912). Although Moure's argument is not valid, Cockerell's (1900) type designation for *Megalopta* should be set aside in favor of Ducke's (1912) designation, if a confusing nomenclatural change is to be avoided. A proposal designed to accomplish this has been prepared and sent to the International Commission on Zoological Nomenclature (Michener and Moure, 1964). In this way the name *Reepenina* can be conserved for the group described below.

This subgenus of *largely testaceous* bees with large ocelli is suggestive of the tropical American *Megalopta* (Halictinae) although not at all metallic. Possibly, like *Megalopta*, it is nocturnal or partly so, although many specimens have been taken by day and none at night, so far as I know.

Ocelli large, ocellular distance usually less than ocellar diameter, but in *floreana* and *bidentata* as well as *variabilis* and some of its

"varieties," equal to ocellar diameter; face rather elongate; glossa as long as eye (longer than eye in most *Nomia* of our area). Comb of hairs on first basitarsus of female absent; *scutellum of male bituberculate*, of female simple; metanotum simple; propodeum with sloping basal zone weakly outlined; basitibial plate of female small and slender, much narrower than base of tibia, apex acute; inner hind tibial spur of female finely serrate; *hind wing with darkened area due to dense, minute hairs along costa beyond hamuli*. Metasoma with neither color bands nor bands of pubescence.

DISTRIBUTION: Northern Queensland, New Guinea, Bismarck Archipelago, Kai, Misool.

INCLUDED SPECIES

Nomia (Reepenia) bidentata Smith, 1863 (Ox.) Misool

bituberculata (Smith, 1853) (*Megalopta*) (B.M.).

Incorrectly attributed to Brazil but presumably Australian

eboracina Cockerell, 1912c (U.S.N.M.)

floreana Smith, 1863 (Ox.) Misool

fuliginosa Friese, 1909 ("typus" W.) New Guinea

fulviventrifera Cameron, 1901 (B.M.) New Guinea
fulviventrifera Friese, 1909 (desc.) Kai. Preoccupied by Cameron, 1901, but not renamed since it is probably a synonym of one of the other names

testacea (Smith, 1854) (*Tetralonia*) (B.M.). Incorrectly attributed to Africa but actually Australian

triangulifera Friese, 1909 ("typus" W.) New Guinea. Preoccupied by Vachal, 1897, but not renamed since it is probably a synonym of one of the other names

variabilis Friese, 1909 ("typus" W.) New Guinea

zebrae Friese, 1909 ("typus" W.) New Britain

The synonymy of *bituberculata* is indicated in Appendix 2.

PTILONOMIA, NEW SUBGENUS

Plate 13, figures 6, 7; text figures 521, 554-559

TYPE: *Nomia plumosa*, new species.

This subgenus is most closely related to *Reepenia* from which it differs in the short glossa, the long malar area, the normal-sized ocelli, the weakness of the darkening along the costa of the hind wing beyond the hamuli, and the black integument. The hair of the

head and thorax is long, loose, and very coarsely plumose. In this respect and in the long malar area, *Ptilonomia* resembles *Mellitidia* from which it differs by the finely serrate inner hind tibial spur of the female (like that of *Reepenia*), the broader basitibial plate of the female, and the unmodified metanotum.

Face rather elongate; *malar space as long as broad in female, twice as long as broad in male*; glossa shorter than clypeus and exceeded by both labial and maxillary palpi; comb of hairs on front basitarsus of female absent; scutellum of male bituberculate as in *Reepenia*, of female simple; metanotum simple; propodeum with somewhat concave, sloping basal zone margined except medially by a carina; basitibial plate of female small, slender, much narrower than base of tibia, apex acute (as in *Reepenia*); inner hind tibial spur of female finely serrate (as in *Reepenia*); hind wing with faintly darkened narrow area along costa beyond hamuli because of dense setulae. Metasoma with neither color bands nor hair bands.

DISTRIBUTION: New Guinea.

INCLUDED SPECIES

Nomia (Ptilonomia) plumosa Michener, new species (Bishop)

SUBGENUS MELLITIDIA GUÉRIN-MÉNEVILLE

Plate 13, figures 3-5; text figures 527, 528, 548-553

Mellitidia GUÉRIN-MÉNEVILLE, 1830, p. 270. [The volume bears the date 1830 but the introduction (presumably distributed later) is dated 1838.] Type: *Andrena australia* Guérin-Méneville, 1830 (monobasic).

The type species of this subgenus, one of the most distinct groups of *Nomia*, has hitherto been variously misunderstood, assigned to *Andrena* (which does not occur in the area), and ascribed to the Australian fauna (although clearly described from New Ireland). Comparison of the species listed below (especially *dentata* or *cincta*, which may represent a single species) with the description of *australis* indicates excellent agreement (note especially the tridentate mandibles which were well illustrated by Guérin-Méneville). A discrepancy exists in the wings; Guérin-Méneville's drawing was

obviously crude, and the description was probably prepared from it, so that the proportions of the submarginal cells are not correct. Secondly, Guérin-Méneville says that there are four projections ("lanieres") at the apex of the labium; actually there are three as in other bees, the paraglossae being long and hairy and constituting the lateral ones. Perhaps the glossa was damaged or dirty in such a way as to make it appear double. Students must be cautioned that Rayment's (1935) "copies" of Guérin-Méneville's illustrations are thoroughly inaccurate and highly deceptive.

An unusual feature of the subgenus is the very long, dense scopa on the lateral portions of the propodeum and on the hind femora.

Mandible of female somewhat enlarged apically and tridentate; malar space half as long as wide to twice as long as wide. Comb of hairs on front basitarsus of female absent; *metanotum with large median tubercle* (obtuse in *metallica*, almost absent in *simplicinotum*); propodeum entirely declivous except in *simplicinotum*, triangle distinct but without sloping or subhorizontal basal area except in *simplicinotum*; basitibial plate of female small and slender, almost parallel sided, much narrower than basal width of tibia (except that in *metallica* it is broader, but angulate apically); *inner hind tibial spur of female pectinate* because of two large projections. Metasoma with tergal margins without hair bands, often translucent yellowish.

Nomia metallica and *gressitti* differ from all the rest by their beautiful dark metallic green color which is much stronger than that of such Australian species as *flavoviridis* and suggestive of some of the less brilliant Neotropical *Augochloropsis*. *Nomia simplicinotum* is weakly metallic. *Nomia longicornis* is placed with hesitation, since the female is unknown. It is slightly metallic like members of the *flavoviridis* group of *Austronomia* but lacks tergal hair bands. There is no pronotal carina or lamella. The malar space is almost half as long as wide. The scutellum and metanotum are unmodified. The propodeal triangle is short, irregularly longitudinally carinate and pitted, almost wholly on the dorsal surface of the propodeum, so that the triangle and enclosure are synonymous. The discovery of *simplicinotum* shows that the

above-mentioned thoracic characters are found in species of *Mellitidia*, and it seems likely that *longicornis* is a relative of *simplicinotum*.

Nomia horvathi has a bispinose scutellum; in this respect it differs from the related species.

Mellitidia manskii Rayment is a species of the halictine genus *Sphecodes*, not closely related to *Nomia*, as examination of the type shows.

DISTRIBUTION: Northern Queensland, New Guinea, Bismarck Archipelago, Kai, Misool, Aru, Seram, Waigeo.

INCLUDED SPECIES

- Nomia (Mellitidia) australis* (Guérin-Méneville, 1830) (*Andrena*) n. comb. (desc.) New Britain¹
cincta Smith, 1859b (B.M.) Kai
dentata Smith, 1859b (B.M.) Aru
gressitti Michener, new species (Bishop) New Guinea
horvathi Friese, 1909 ("typus" W.) New Guinea
kochi Friese, 1909 (desc.) New Guinea
longicornis Smith, 1859b (Ox.) Aru
luteiventris Friese, 1909 (H.N.M.) New Britain
metallica Smith, 1863 (not Cameron, 1901) (Ox.) Waigeo
simillima Smith, 1863 (not 1875) (Ox.) Seram
simplicinotum Michener, new species (Bishop) New Guinea
tomentifera Friese, 1909 ("typus" W.) New Guinea, Queensland

SUBFAMILY HALICTINAE

This is an enormous and worldwide subfamily of bees, many of which are semisocial or primitively social. Although none of the species of our area is known to have worker and queen castes, many of them live in colonies, several females jointly occupying a single nest. Claims of female versus bisexual generations are apparently false; nearly all females found on flowers in Australia are fertilized. The nests are burrows in the ground or less commonly in rotten wood. Michener (1960a) summarized the data on the behavior and lack of castes in Australian species and cited other publications on the subject. Sakagami and Michener (1962) sum-

¹ I have now seen the type in the Museo Civico di Storia Naturale Giacomo Doria in Genoa. Only the thorax and first metasomal segment remain, but they are clearly *Mellitidia* as here interpreted.

marized information on nest structures of Australian species. Rayment (1935) described an interesting cell cluster of *Lasioglossum* (*Callalictus*) *anomalum* which was not considered in the reviews cited above because the species has hitherto been placed in the wrong family, as a species of *Collo-melitta*.

In addition to keys to the species given by Cockerell in the series on "The bees of Australia" cited in the section on Previous Work on the Bees of Australia and the South Pacific, Cockerell (1904a) gave a key to Smith's *Halictus* from Australia. These species now fall in both *Lasioglossum* and *Homalictus*.

KEY TO THE GENERA OF THE HALICTINAE OF THE AUSTRALIAN REGION

1. Body with yellow integumental markings, including yellow bands on the metasoma; fifth tergum of female without longitudinal median furrow or distinctive hair pattern *Nomioides*
Yellow integumental markings absent or limited to clypeus and very rarely other parts of face and to males; fifth tergum of female (except in *Sphecodes*) with longitudinal median furrow or line, rarely merely a triangular area (*Echthralictus*), fringed by prepygidial fimbria which in this area extends onto disc of tergum 2
2. Third transverse cubital as strong as preceding one; basitibial plate not defined by carinae; head and thorax exceedingly coarsely pitted and propodeal enclosure very coarsely rugose; metasoma shining red, black, or blue; scopa absent; prepygidial fimbria and longitudinal median area of fifth tergum absent. *Sphecodes*
Third transverse cubital weaker than first and second except in a few males and in females of a species of *Lasioglossum*, *sensu stricto*, from New Guinea and the Solomon Islands; basitibial plate defined in females and many males (defined only anteriorly in some females of *Homalictus*); head and mesosoma less coarsely punctate, metasoma less shining; scopa usually present on hind legs; prepygidial fimbria of female present and surrounding longitudinal median furrow, line, or triangular area 3
3. Dorsolateral angles of pronotum slender, erect, and acute; scopa on legs wanting; labral process of female without longitudinal keel but with weak median carina rising but little

above level of bases of marginal bristles (Samoa) *Echthralictus*
Dorsolateral angles of pronotum obtuse, rarely (*Homalictus ctenander*) produced as flat, rounded lobes which are acute if seen edge-wise; hind femora with abundant, curled, scopal hairs; labral process of female with longitudinal keel which in *Homalictus* is in some cases depressed so that keel is not apparent but surface is above and overhangs bases of marginal bristles 4

4. Metasoma of female flattened, terga folded under at sides, usually with a distinct angle separating ventral parts from dorsal parts; metasomal scopa consisting of very long plumose hairs arising not only from sterna but from ventral parts of terga, scopal hairs from terga directed posteromesially; male genitalia not much broadened and gonobase more or less continuing gonocoxal contours *Homalictus*
Metasoma of female not strongly flattened, terga curving over sides and not angulate; metasomal scopa absent or consisting of relatively short sternal hairs; male genitalia large and broad, gonobase not at all continuing gonocoxal contours *Lasioglossum*

HALICTINAE NOT PLACED IN THE PRESENT CLASSIFICATION

- minimus* Meyer, 1919 (*Parasphecodes*) (desc. Berlin)
nigritus Meyer, 1919 (*Parasphecodes*) (desc. Berlin)
percallomelittinus Rayment, 1954a (*Parasphecodes*) (desc.)
portlandensis Rayment, 1953a (*Halictus*) (desc.)

GENUS LASIOGLOSSUM CURTIS

Plate 13, figures 10-12; plate 14, figures 1-7;
text figures 564-602, 609-627

This enormous, worldwide genus contains many of the species hitherto placed in *Halictus*, and in addition those that have been placed in *Parasphecodes*. I have no hesitancy in disregarding tradition and lowering *Parasphecodes* to subgeneric rank (see discussion under that subgenus). It is with some hesitancy that I use *Lasioglossum* rather than *Halictus* for all the species of the Australian and South Pacific regions. As shown by Sandhouse (1941) and by me (Michener, 1944), *Halictus* differs by some rather striking characters (e.g., apical tergal hair bands, strong distal veins in the wing) from a large number of species to which the name *Lasio-*

glossum has been applied since about 1944. Studies of the genitalia, hidden sterna, and other characters support the generic distinctness of *Halictus* from *Lasioglossum*. *Halictus* proper occurs in the Holarctic Region, is especially abundant in Africa, scarce in the American tropics, and does not occur in the Malayan Region, the East Indies, or Australia.

The name *Chloralictus* has been used in a subgeneric sense for small greenish halictines in Australia. This is quite incorrect, *Chloralictus* properly being applicable to greenish species with *Evylla*-like wings and being absent from the Australian area. Most of the Australian "*Chloralictus*" belong in the genus *Homalictus*, the remainder in the subgenus *Chilalictus* of *Lasioglossum*; in neither group is the greenish color a subgeneric character. In both groups forms occur in which the greenish is barely detectable, and others in which the females are green, the males black.

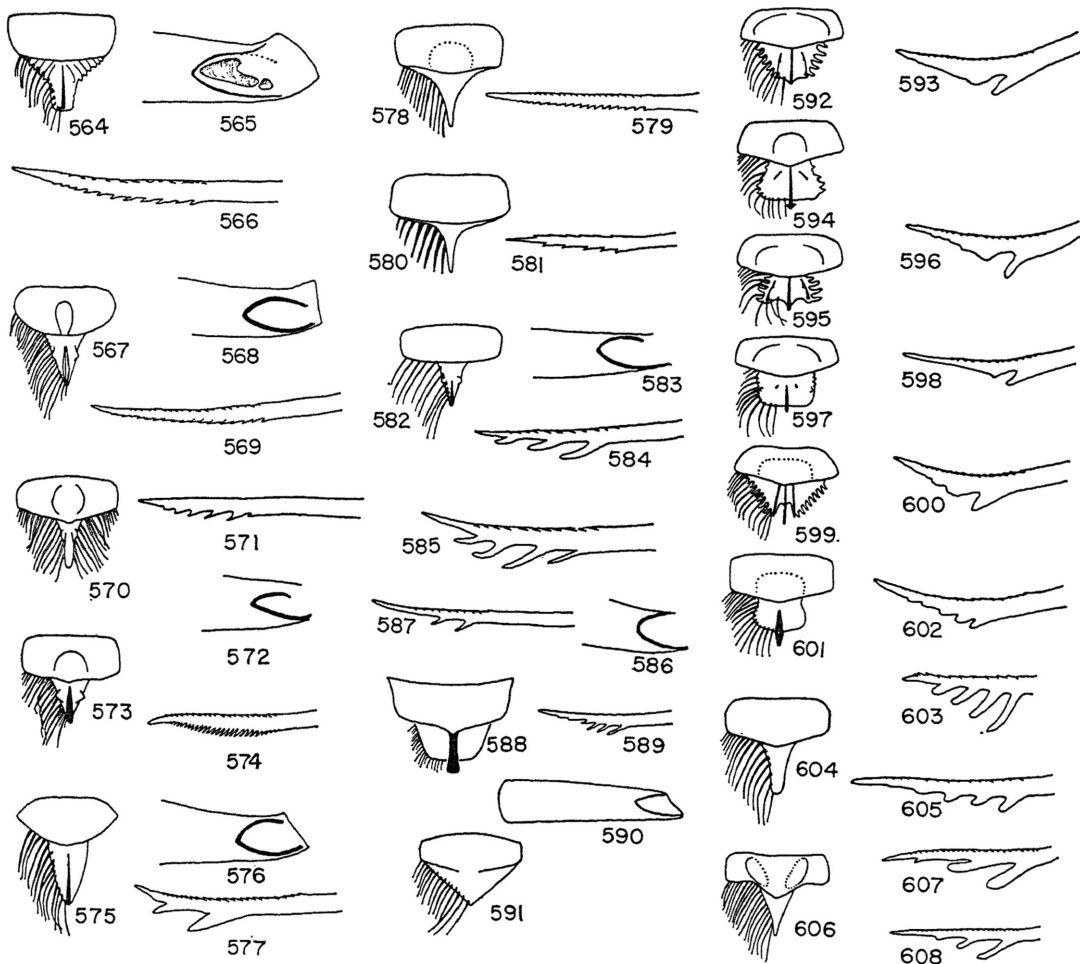
Three of the subgenera, *Parasphecodes*, *Australictus*, and *Callalictus*, constitute an Australian group not found elsewhere in the world. *Pseudochilalictus* probably also belongs to this group, although the male is unknown. These subgenera can be recognized by their usually large size, slender body and long antennae of the males, and lack of basitibial plates in the males. The other Australian subgenera have more nearly the aspect of *Lasioglossum* proper and are probably rather closely related to one another.

KEY TO THE SUBGENERA OF *Lasioglossum* OF THE AUSTRALIAN REGION

1. Second transverse cubital vein in both sexes narrower than first; small (less than 7 mm. long), dull, nonmetallic species with tibial spurs finely serrate, essentially simple, or in some cases with a few large oblique teeth *Austrevylaeus*
Second transverse cubital vein as strong as first; if body less than 7 mm. long, then inner hind tibial spur of female with one to several large teeth 2
2. Females 3
Males 10
3. Labral process triangular, widest at base, tapering to pointed apex which is usually simple except for being keeled (two keels or processes in a few *Parasphecodes*, process broadened preapically in a few *Lasio-*

- glossum*, *sensu stricto*). (Basitibial plates usually rather elongate and pointed apically.) 4
- Labral process broadened, so that it does not taper uniformly to a pointed apex, lateral margins often pectinate, toothed, elevated, or otherwise modified 8
4. Inner hind tibial spur finely serrate or essentially simple 5
Inner hind tibial spur pectinate (coarsely serrate in a few species) 6
5. Metasomal terga black, with broad basal bands of tomentum; teeth of inner margin of inner hind tibial spur long (fig. 574) *Pseudochilalictus*
Metasomal terga red or black, metallic in one species, without tomentum; teeth of hind tibial spur shorter *Parasphecodes*
6. Propodeal triangle smooth, enclosure not margined; thorax partially or wholly red or testaceous; metasomal terga without basal bands of tomentum *Callalictus*
Propodeal triangle variously roughened, enclosure often margined by a carina; thorax black; metasomal terga usually with tomentum basally or basolaterally 7
7. Glossa more than one and one-half times as long as head; outer margin of front basitarsus with comb of hairs distinctly differentiated from rest of vestiture; scopa of trochanter and femur very sparse, long, hairs with few side branches *Nesohalictus*
Glossa shorter than head; outer margin of front basitarsus without differentiated comb of hairs; scopa dense, hairs with fine, close side branches *Lasioglossum*,¹ *sensu stricto*
8. Inner hind tibial spur of female pectinate; glossa two-thirds as long as face; margin of labral process of female simple *Glossalictus*
Inner hind tibial spur not pectinate; glossa little more than half as long as face; margin of labral process of female variously modified 9
9. Inner hind tibial spur with a large tooth followed by a wavy margin, tooth in some cases reduced so that margin is almost simple, rarely a second tooth developed so that spur is almost pectinate; eyes usually bare but in some cases with rather long hairs *Chilalictus*
Inner hind tibial spur very finely serrate, thus

¹ See also the small species of *Parasphecodes*, some of which have coarsely serrate or pectinate hind tibial spurs and hence run here. They differ by having the metasoma red, and differ from most *Lasioglossum*, *sensu stricto*, by lacking basal bands of tomentum on the metasoma.



FIGS. 564-608. Labrum, inner hind tibial spur, and basitibial plate of female (except as otherwise noted) of Halictinae. 564-566. *Lasioglossum (Australictus) peraustrale*. 567-569. *L. (Parasphcodes) musicum*. 570, 571, *L. (P.) olgae* (holotype). 572. *L. (P.) clarigaster*. 573, 574. *L. (Pseudochilalictus) imitator*. 575-577. *L. (Callalictus) tooloomense*. 578, 579. *L. (Austrevylaeus) sordidum*. 580, 581. *L. (A.) melanurum*. 582-584. *L. (Lasioglossum) repertulum*. 585, 586. *L. (L.) stirlingi*. 587. *L. (L.) sturii*. 588-591. *L. (Glossalictus) etheridgei* (590, whole tibia; 591, labrum of male). 592, 593. *L. (Chilalictus) wahlenbergiae*. 594. *L. (C.) cephalochilum*. 595, 596. *L. (C.) gynochilum*. 597, 598. *L. (C.) obscurissimum*. 599, 600. *L. (C.) leai*. 601, 602. *L. (C.) helichrysi*. 603. *Homalictus urbanus*. 604, 605. *H. dampieri*. 606-608. *H. ctenander* (608, spur of male).

- essentially simple; eyes with a few short hairs *Australictus*
10. Basitibial plates present (except in a very few species); small to moderate-sized species; eyes bare 11
- Basitibial plates absent; large to moderate-sized species; eyes (except in some *Callalictus*) with scattered, very short hairs . 14
11. Glossa two-thirds as long as face or longer . 12
- Glossa about half as long as face 13
12. Glossa about two-thirds as long as face which

- is broader than long *Glossalictus*
- Glossa longer than face which is longer than broad *Nesohalictus*
13. Gonostylus less than half as long as gonocoxite (males of Australian species not available) *Lasioglossum, sensu stricto*
- Gonostylus more than half as long as gonocoxite (except in *idoneum*), in some cases as long as gonocoxite *Chilalictus*
14. Genital stylus almost absent or at most short and triangular *Australictus*

- Genital stylus distinct and longer than broad.
(Metasomal terga without basal bands of
tomentum.) 15
15. Propodeal triangle smooth, enclosure not margined; thorax partly or wholly red or testaceous *Callalictus*
- Propodeal triangle roughened, enclosure usually defined; thorax black . . . *Parasphecodes*

AUSTRALICTUS, NEW SUBGENUS

Plate 14, figures 5, 6; text figures 564-566,
609-611, 618, 619

TYPE: *Halictus peraustralis* Cockerell, 1904.

In size, form (including the long male antennae), the serrate hind tibial spurs of the female, and genital structure this subgenus shows its close relationship to *Parasphecodes*. It differs from that subgenus, however, in the characters italicized below.

Body rather large, nonmetallic, metasoma black or (in *fulvofasciae*) with broad apical fulvous bands on terga or basally dark reddish (*plorator*); labral process of female broad, rounded or truncate apically, margin laterally usually tuberculate or pectinate; eyes with short, sparse hairs. Second transverse cubital vein strong; basitibial plate of female rather slender and narrowly rounded or pointed apically, of male absent; inner hind tibial spur of female very finely serrate or essentially simple; metasomal terga usually with at least faint indications of basal bands of tomentum; genitalia of male broad, stylus short and broad, scarcely recognizable; ventroapical process of gonocoxite large.

In *franki* and *fulvofasciae* there is hardly any tomentum on the basolateral portions of the terga and in *davide*, *kurandense*, *nigroscopaceum*, and *plorator* there is none. This group virtually grades into *Parasphecodes*. Typical members have the propodeal area smooth and not defined by a carina, the margins of the basitibial plate of the female broad and the plate itself elongate, and have broad metasomal bands of tomentum. In *franki*, *davide*, *kurandense*, and *nigroscopaceum* the propodeal area is margined or striate and the basitibial plate, too, is as in *Parasphecodes*. In the more typical members of the subgenus the dorsolateral angles of the pronotum are larger than in most *Parasphecodes*, although they are also large in some species of that

subgenus (e.g., *musicum*). The species that, in one or another feature, approach *Parasphecodes*, and resemble *Parasphecodes* in appearance, are placed in group *b*. Except for *fulvofasciae*, species of group *b* have smooth, slightly elevated, dorsolateral convexities on the first two metasomal terga (weak in *franki*); similar convexities are found in some *Parasphecodes* (e.g., *bribiense* and *cervicale*) and on the first segment only of species of group *a*. These structures are not very helpful from the standpoint of classification; they are mentioned here only because they were the basis for Cockerell's subgenus *Aphalictus* of *Parasphecodes*, which does not appear to be a useful grouping.

DISTRIBUTION: Tasmania and South Australia to northern Queensland.

INCLUDED SPECIES

- Lasioglossum (Australictus)* (b) *davide* (Cockerell, 1910a) (*Halictus*) n. comb. (B.M.)
- (b) *franki* (Friese, 1924) (*Halictus*) n. comb. ("typus" A.M.N.H.)
- (a) *fulvofasciae* Michener, new species (Q.M.)
- (a) *insculptum* (Cockerell, 1918b) (*Parasphecodes*) n. comb. (Q.M.)
- (b) *kurandense* (Cockerell, 1914d) (*Halictus*) n. comb. (B.M.)
- (b) *nigroscopaceum* (Friese, 1917) (*Halictus*) n. comb. ("typus" A.M.N.H., W.)
- (a) *odyneroides* (Rayment, 1939) (*Halictus*) n. comb. (desc.)
- (a) *peraustrale* (Cockerell, 1904a) (*Halictus*) n. comb. (B.M.)
- (b) *plorator* (Cockerell, 1910h) (*Parasphecodes*) n. comb. (B.M.)
- (a) *rufitarsum* (Rayment, 1929c) (*Parasphecodes*) n. comb. (N.M.V.)
- (a) *tertium* (Dalla Torre, 1896) (*Halictus*) n. comb. = *Halictus rufipes* Smith, 1853, not *Andrena rufipes* Fabricius, 1793 (B.M.)

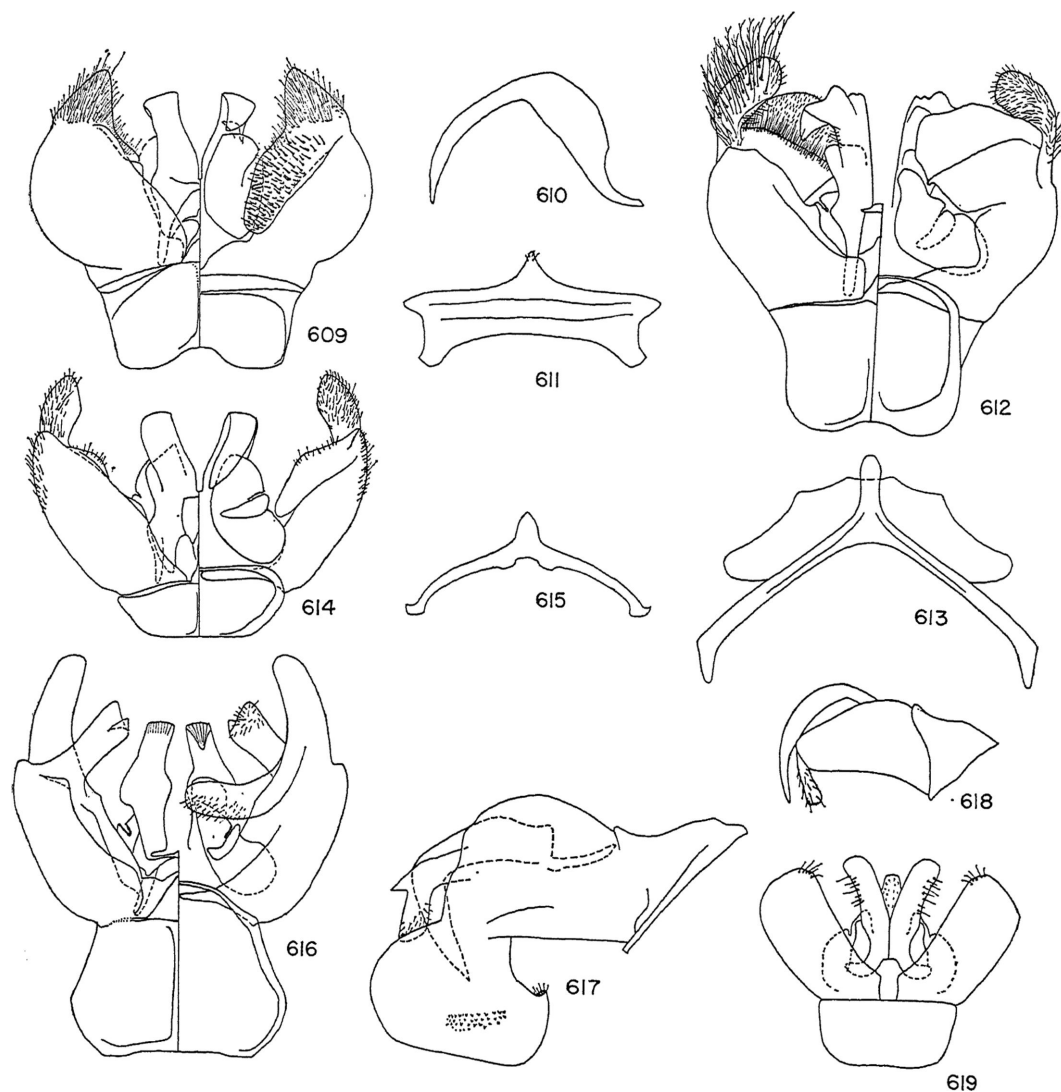
SUBGENUS PARASPECODES SMITH

Text figures 567-572, 614, 615

Parasphecodes SMITH, 1853, p. 39. Type: *Parasphecodes hilactus* Smith, 1853, designation of Sandhouse, 1943, p. 585.

Aphalictus COCKERELL, 1930b, p. 40. Type: *Parasphecodes bribiense* Cockerell, 1916 (original designation).

This large subgenus has hitherto received generic rank from all authors except Friese, although defined only as large Australian species of "*Halictus*" with the metasomas red,



FIGS. 609-619. Halictinae. 609. Male genitalia of *Lasioglossum (Australictus) peraustrale*. 610. Side view of penis valve of same. 611. Attached seventh and eighth sterna of same. 612, 613. Male genitalia and attached seventh and eighth sterna of a species near *L. (Callalictus) tooloomense*. 614, 615. Male genitalia and seventh sternum of *L. (Parasphecodes) musicum*. 616. Male genitalia of *L. (Callalictus) tooloomense*. 617. Lateral view of same. 618, 619. Sketches of lateral and dorsal aspects of male genitalia of *L. (Austrevylaeus) sordidum*.

plus forms with the metasoma black if obviously related to such species. The obvious inadequacy of such a definition is shown by the number of forms described in *Halictus* and here transferred for the first time to *Parasphecodes*. The group, as here delimited, is homogeneous and is a conspicuous and distinctive element of the Australian fauna. It has two close relatives, *Australictus* and

Callalictus, both of which it resembles in large size, the long antennae of the male and the rather long body of the male, the lack of basitibial plates in the male, and the general form of the male genitalia. It differs from both in the usually smaller dorsolateral angles of the pronotum, the roughened or striate propodeal enclosure often bounded by a carina, and the size of the male gonostylus.

Large nonmetallic forms except for the Papuan *permetallicum*, often with the metasoma red or partly so; process of labrum of female not broadened, tapering to a point or in some cases with apex bilamellate (*speculiferum*); eyes with short, sparse hairs. Second transverse cubital vein strong; basitibial plate of female pointed, of male absent; inner hind tibial spur of female finely serrate or virtually simple (rarely coarsely serrate or pectinate in small species). Metasoma without bands of tomentum; male genitalia broad, lateral margins usually angulate, gonostylus short (in some cases with long hair which may give it a superficially long appearance), ventroapical process of gonocoxite long.

The inner hind tibial spur of the female is more coarsely serrate than usual in a group of rather small species including *doddi*, *paracolletinum*, *leichardti*, and *basilautum*. *Lasioglossum waterhousei*, *musicum*, *olgae*, and others are unusual in having a tubercle on each side of the labral process of the female. They thus approach the closely related *Australictus*, but the labral process tapers to a point, unlike that of members of that subgenus. *Lasioglossum testaciventre* has an oblique dorsolateral carina on each side of the labral process and is unusual also in the protuberant basal part of the labrum. For a discussion of species of *Australictus* which approach *Parasphecodes*, see the comments under the former subgenus. The only species known from New Guinea (*permetallicum*) is unique in being strongly metallic green; unfortunately the male is unknown, but in the characters of the female it does not differ in major features from typical *Parasphecodes*.

An interesting group of little-known forms is marked by the letter *a* in the list below. All are very small for *Parasphecodes*. *Lasioglossum olgae* has the hind tibial spur coarsely serrate, while *L. clarigaster* and *tribuarius* have it pectinate. In this respect they differ from other *Parasphecodes*, but they agree in other features and are hence included. Interestingly enough these species are also very similar to the species of *Austrevylaeus* with the metasoma red. Discovery of the males, currently unknown or unrecognized for all of them, may show that a close relationship exists or that the species of *Austrevylaeus* con-

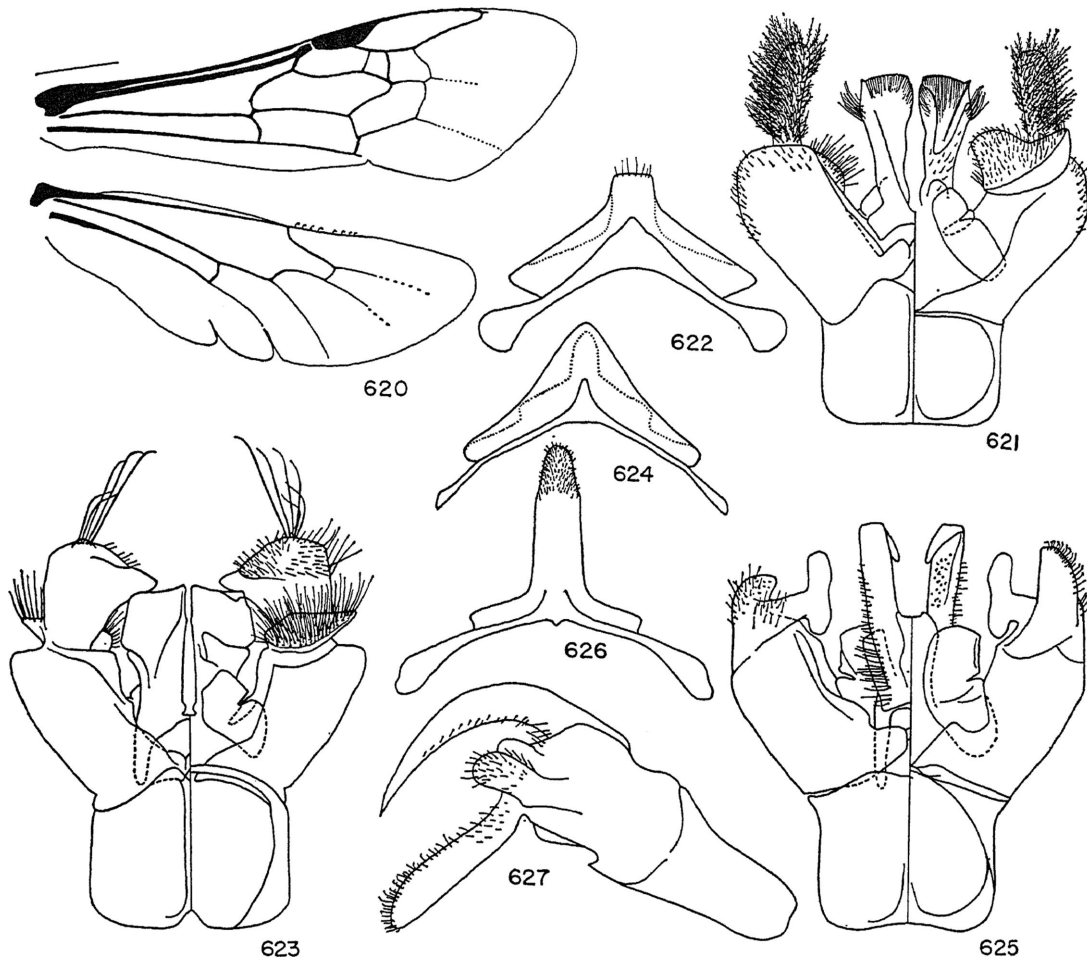
cerned should be transferred to *Parasphecodes*.

DISTRIBUTION: Tasmania and Australia north to northern Queensland and northwest Australia; one species in New Guinea.

INCLUDED SPECIES

- Lasioglossum* (*Parasphecodes*) *adelaidae* (Cockerell, 1905c) (*Parasphecodes*) n. comb. (B.M.)
altichum (Smith, 1853) (*Parasphecodes*) n. comb. (B.M.)
anhybodinum (Cockerell, 1930b) (*Parasphecodes*) n. comb. (Q.M.)
annexum (Cockerell, 1922a) (*Parasphecodes*) n. comb. (Q.M.)
arciferum (Cockerell, 1914c) (*Parasphecodes*) n. comb. (C.S.I.R.O.)
atronitens (Cockerell, 1914k) (*Parasphecodes*) n. comb. (Q.M.)
atrourufescens (Cockerell, 1914c) (*Paracolletes*) n. comb. (C.S.I.R.O.)
basilautum (Cockerell, 1910a) (*Parasphecodes*) n. comb. (B.M.)
bribiense (Cockerell, 1916d) (*Parasphecodes*) n. comb. (Q.M.)
bribiensiforme (Cockerell, 1930b) (*Parasphecodes*) n. comb. (Q.M.)
bryotrichum (Cockerell, 1912b) (*Parasphecodes*) n. comb. (C.S.I.R.O.)
butleri (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
carbonarium (Smith, 1853) (*Halictus*) n. comb. (B.M.)
cervicale (Cockerell, 1915e) (*Parasphecodes*) n. comb. (B.M.)
cirriferum (Cockerell, 1910a) (*Parasphecodes*) n. comb. (B.M.)
(a) *clarigaster* (Cockerell, 1918b) (*Halictus*) n. comb. (B.M.)
dissimulator (Cockerell, 1914c) (*Parasphecodes*) n. comb. (C.S.I.R.O.)
doddi (Cockerell, 1914h) (*Halictus*) n. comb. (B.M.)
excultum (Cockerell, 1913b) (*Parasphecodes*) n. comb. (C.S.I.R.O.)
flavopunctatum (Friese, 1924) (*Nomia*) n. comb.
forresti (Cockerell, 1906c) (*Halictus*) n. comb. (B.M.)
frenchellum Michener, new name for *Halictus frenchi* Rayment, 1935, A cluster of bees, p. 701, not *Parasphecodes frenchi* Cockerell, 1904a (C.S.I.R.O.)
frenchi (Cockerell, 1904a) (*Parasphecodes*) n. comb. (B.M.)
froggatti (Cockerell, 1905c) (*Parasphecodes*) n. comb. (B.M.)

- fultoni* (Cockerell, 1914c) (*Parasphecodes*) n. comb. (U.S.N.M.)
fulviventre (Friese, 1924) (*Halictus*) (desc.) n. comb.
fumidicauda (Cockerell, 1914c) (*Parasphecodes*) n. comb. (Q.M.)
gentianae (Rayment, 1951b) (*Parasphecodes*) n. comb. (C.S.I.R.O.)
gibbosum (Friese, 1924) (*Halictus*) ("typus" A.M.N.H.) n. comb.
grande (Meyer, 1919) (*Parasphecodes*) n. comb. (desc. Berlin)
griseipenne (Cockerell, 1929a) (*Parasphecodes*) n. comb. (C.S.I.R.O.)
hilactum (Smith, 1853) (*Parasphecodes*) n. comb. (B.M.)
hiltacum (Smith, 1853) (*Parasphecodes*) n. comb. (B.M.)
hirtiventre (Cockerell, 1922a) (*Parasphecodes*) n. comb. (Q.M.)
hybodinum (Cockerell, 1912b) (*Parasphecodes*) n. comb. (C.S.I.R.O.)
insigne (Meyer, 1919) (*Parasphecodes*) n. comb. (desc. Berlin)
lacthium (Smith, 1853) (*Parasphecodes*) n. comb. (B.M.)
latissimum (Cockerell, 1915e) (*Parasphecodes*) n. comb. (C.S.I.R.O.)
leichardti (Cockerell, 1906c) (*Halictus*) n. comb. (B.M.)
leptospermi (Cockerell, 1916d) (*Parasphecodes*) n. comb. (Q.M.)
leucorhinum (Cockerell, 1926b) (*Halictus*) n. comb. (C.S.I.R.O.)
lichatinum (Cockerell, 1922a) (*Parasphecodes*) n. comb. (Q.M.)
lichatum (Smith, 1853) (*Parasphecodes*) n. comb. (B.M.)
lithuscum (Smith, 1853) (*Parasphecodes*) n. comb. (B.M.)
longmani (Cockerell, 1922a) (*Parasphecodes*) n. comb. (Q.M.)
loweri (Cockerell, 1905c) (*Parasphecodes*) n. comb. (B.M.)
melbournense (Cockerell, 1904a) (*Parasphecodes*) n. comb. (B.M.)
microdontum (Cockerell, 1912b) (*Parasphecodes*) n. comb. (B.M.)
musicum (Cockerell, 1913f) (*Halictus*) n. comb. (B.M.)
noachinum (Cockerell, 1914c) (*Parasphecodes*) n. comb. (U.S.N.M.)
niveorufum (Friese, 1924) (*Halictus*) n. comb. ("typus" A.M.N.H.)
niveatum (Meyer, 1919) (*Parasphecodes*) n. comb. (desc. Berlin)
notescens (Cockerell, 1930b) (*Parasphecodes*) n. comb. (Q.M.)
- (a) *olgae* (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
paracolletinum (Cockerell, 1910a) (*Halictus*) n. comb. (B.M.)
paramelaenum (Cockerell, 1922a) (*Parasphecodes*) n. comb. (Q.M.)
patongense (Rayment, 1948b) (*Halictus*) n. comb. (C.S.I.R.O.)
permetallicum Michener, new species (B.M.) New Guinea
perustum (Cockerell, 1914g) (*Parasphecodes*) n. comb. (B.M.)
pilicolle (Friese, 1924) (*Halictus*) n. comb. (desc.)
proximum (Rayment, 1947) (*Parasphecodes*) n. comb. (desc.)
punctatissimum (Meyer, 1919) (*Parasphecodes*) n. comb. (desc. Berlin)
recantans (Cockerell, 1912b) (*Parasphecodes*) n. comb. (B.M.)
recessum (Cockerell, 1914g) (*Parasphecodes*) n. comb. (B.M.)
rhodopterum (Cockerell, 1914m) (*Parasphecodes*) n. comb. (C.S.I.R.O.)
rubriventre (Friese, 1924) (*Halictus*) n. comb. (desc.)
rufulum (Friese, 1924) (*Halictus*) n. comb. (desc.)
rufotegulare (Cockerell, 1914m) (*Parasphecodes*) n. comb. (U.S.N.M.)
scutellatum (Friese, 1924) (*Halictus*) n. comb. (desc.)
schomburgki (Cockerell, 1910a) (*Parasphecodes*) n. comb. (desc. Berlin)
sextum (Cockerell, 1910a) (*Parasphecodes*) n. comb. (desc. Berlin)
solis (Cockerell, 1922a) (*Parasphecodes*) n. comb. (Q.M.)
sordidulum (Cockerell, 1914h) (*Parasphecodes*) n. comb. (Q.M.)
speculiferum (Cockerell, 1912b) (*Parasphecodes*) n. comb. (B.M.)
stuchilum (Smith, 1853) (*Parasphecodes*) n. comb. (B.M.)
subfultoni (Cockerell, 1930b) (*Parasphecodes*) n. comb. (Q.M.)
submeracum (Cockerell, 1930b) (*Parasphecodes*) n. comb. (Q.M.)
submoratum (Cockerell, 1930b) (*Parasphecodes*) n. comb. (Q.M.)
subrussatum (Cockerell, 1922a) (*Parasphecodes*) n. comb. (Q.M.)
sulthicum (Smith, 1853) (*Parasphecodes*) n. comb. (B.M.)
talchium (Smith, 1853) (*Parasphecodes*) n. comb. (B.M., Ox.)
taluche (Smith, 1853) (*Parasphecodes*) n. comb. (B.M.)



FIGS. 620–627. Halictinae. 620. Wings of *Lasioglossum* (*Pseudochilalictus*) *imitator* (scale line represents 1 mm.). 621, 622. Male genitalia and attached seventh and eighth sterna of *L.* (*Chilalictus*) *wahlenbergiae*. 623, 624. Same of *L.* (*Glossalictus*) *etheridgei*. 625, 626. Same of *L.* (*Nesohalictus*) *halictoides*. 627. Side view of male genitalia of *L.* (*N.*) *halictoides*.

- | | |
|--|---|
| <i>tepperi</i> (Cockerell, 1905c) (<i>Parasphecodes</i>)
n. comb. (B.M.) | <i>turneri</i> (Cockerell, 1914g) (<i>Parasphecodes</i>)
n. comb. (B.M.) |
| <i>testaciventre</i> (Rayment, 1953a) (<i>Parasphecodes</i>) n. comb. (C.S.I.R.O.) | <i>vau</i> (Cockerell, 1910a) (<i>Parasphecodes</i>) n. comb. (B.M.) |
| (a) <i>tribuarium</i> (Rayment, 1935) (<i>Halictus</i>) n. comb. (C.S.I.R.O.) | <i>vermiculatum</i> (Cockerell, 1914c) (<i>Parasphecodes</i>) n. comb. (C.S.I.R.O.) |
| <i>tilachiforme</i> (Cockerell, 1907a) (<i>Parasphecodes</i>) n. comb. (A.M.N.H.) | <i>vulneratum</i> (Cockerell, 1910a) (<i>Parasphecodes</i>) n. comb. (B.M.) |
| <i>tilachum</i> (Smith, 1853) (<i>Parasphecodes</i>) n. comb. (B.M.) | <i>warburtoni</i> (Cockerell, 1906c) (<i>Halictus</i>) n. comb. (B.M.) |
| <i>trimaculatum</i> (Friese, 1924) (<i>Halictus</i>) n. comb. (desc.) | <i>waterhousei</i> (Cockerell, 1915d) (<i>Halictus</i>) n. comb. (B.M.) |
| <i>tripunctatum</i> (Cockerell, 1929a) (<i>Parasphecodes</i>) n. comb. (A.M.N.H.) | <i>wellingtoni</i> (Cockerell, 1914g) (<i>Parasphecodes</i>) n. comb. (B.M.) |
| <i>tuchilas</i> (Smith, 1853) (<i>Parasphecodes</i>) n. comb. (B.M.) | <i>wilmattae</i> (Cockerell, 1929a) (<i>Parasphecodes</i>) n. comb. (C.S.I.R.O.) |

zamelanum (Cockerell, 1930b) (*Parasphcodes*) n. comb. (Q.M.)

PSEUDOCHILALICTUS, NEW SUBGENUS

Plate 14, figure 7; text figures 573, 574, 620

TYPE: *Lasioglossum imitator*, new species.

The species of this subgenus has exactly the aspect of the common, large species of the subgenus *Chilalictus* such as *L. lanarium*. In fact I originally placed it, uncritically, among such bees, and it is possible that, in determining the subgeneric status of one or more species listed in *Chilalictus*, I failed to recognize them as *Pseudochilalictus*. *Pseudochilalictus* differs in the female from *Chilalictus* by the tapering labral process, the pointed basitibial plate, and the finely toothed inner hind tibial spur. In all these characters it agrees with *Parasphcodes*, from which genus it differs by the tomentous bands on the metasomal terga and the unusually long teeth on the inner hind tibial spur.

Large nonmetallic species with the process of the labrum of the female tapering to a point and with a basolateral tooth on each side; eyes seemingly bare but actually with scattered, exceedingly short hairs. Second transverse cubital vein strong; basitibial plate of female pointed; inner hind tibial spur with fine sharp teeth not greatly different on the two margins, therefore similar to the type often called "ciliate." Metasomal terga with basal bands of tomentum.

DISTRIBUTION: Southern Queensland, New South Wales.

INCLUDED SPECIES

Lasioglossum (*Pseudochilalictus*) *imitator* Michener, new species (C.S.I.R.O.)

Unfortunately the male of this subgenus is unknown.

CALLALICTUS, NEW SUBGENUS

Text figures 575-577, 612, 613, 616, 617

TYPE: *Parasphcodes tooloomensis* Cockerell, 1929.

This subgenus is related to *Parasphcodes* and *Australictus* but differs in the characters italicized below. Further, it differs from *Parasphcodes* by the generally shining body with the propodeal enclosure smooth and not demarked by a carina. The dorsolateral angles

of the pronotum are larger than usual in *Parasphcodes*.

Rather large nonmetallic species, but smaller and more slender than most *Parasphcodes*; thorax, and in some cases metasoma, partially red or yellowish. Labral process of female tapering and pointed, margin not pectinate or otherwise modified; eyes with or without short sparse hairs. Second transverse cubital vein strong (*third submarginal cell usually receiving both recurrent veins*; this condition is rare in other Australian halictines); basitibial plate of female pointed, of male absent; *inner hind tibial spur of female pectinate*. Metasoma without tomentous bands; male genitalia with *stylus of moderate length* (longer than in *Parasphcodes*, shorter than in *Lasioglossum*, *sensu stricto*), often bifid; ventroapical process of gonocoxite enormous, thin and membranous, in some (species illustrated) extending apically as well as basally but extending only basally in most species.

DISTRIBUTION: Victoria to northern Queensland.

INCLUDED SPECIES

Lasioglossum (*Callalictus*) *anomalum* (Rayment, 1935) (*Callomelitta*) n. comb. (C.S.I.R.O.). Preoccupied by *Halictus anomalus* Robertson, 1892, which is also a *Lasioglossum*; not renamed because probably a synonym of another species of *Callalictus*

aurantiacum (Cockerell, 1916d) (*Parasphcodes*) n. comb. (Q.M.)

callomelittinum (Cockerell, 1910a) (*Parasphcodes*) n. comb. (Q.M.)

contaminatum (Cockerell, 1910a) (*Parasphcodes*) n. comb. (B.M.)

musgravei (Cockerell, 1929c) (*Parasphcodes*) n. comb. (A.M.)

ruficollis (Friese, 1924) (*Halictus*) n. comb. (desc.)

rufocollare (Cockerell, 1930b) (*Parasphcodes*) n. comb. (Q.M.)

tooloomense (Cockerell, 1929d) (*Parasphcodes*) n. comb. (Q.M.)

AUSTREVYLAUS, NEW SUBGENUS

Text figures 578-581, 618, 619

TYPE: *Halictus sordidus* Smith, 1853.

This subgenus differs from all others found in the Australian and South Pacific regions in having the second transverse cubital vein,

especially of the female, narrower than the first. In this respect it resembles the subgenera *Evylaeus* and *Chloralictus* found in the Holarctic and Neotropical regions. Most species differ from these subgenera as well as from the superficially similar members of *Chilalictus* of Australia in the finely serrate inner hind tibial spur of the female. The only other Australian species with similar spurs are large bees belonging to the subgenus *Parasphecodes* or its allies. *Austrevylaeus* differs strongly from *Chilalictus*, also, in the absence of the large, membranous ventroapical process of the male genitalia and the rather short stylus. The body is finely punctate. The male is slender, with rather long antennae.

Body small, nonmetallic, black. Labrum of female with process slender, tapering to a point, compressed apically, margins not modified; eyes seemingly without hairs. Second transverse cubital vein narrower than first although stronger than third; basitibial plate of female short and rounded, of male absent (possibly very vaguely outlined when seen from certain views); inner hind tibial spur of female finely serrate, virtually simple (see below). Metasoma without bands of tomentum; male genitalia with stylus rather short, flattened; ventroapical process of gonocoxite small.

The above description is based entirely on the species from New Zealand, which are very similar if not identical to one another. The species from Australia, all unknown to me in the male sex, are included tentatively. *Lasioglossum melanurum* is known to me only from the holotype female which is in poor condition. It differs from New Zealand species in having the basitibial plate somewhat longer, although rounded apically, and in having several small, sharp, widely separated teeth on both margins of the inner hind tibial spur. As in *sordidum*, the teeth of the two margins are about equally numerous and of about equal size. In the absence of more material and especially of males, this species can only be tentatively placed. The same remarks apply to *pertasmaniae* except that the spur is coarsely pectinate on the inner margin only.

The species from eastern Australia, *ewarti*, *exoneuroides*, and *rufibase*, agree with *mela-*

nurum in the features mentioned above except that the basitibial plate is even longer and angulate apically and the inner hind tibial spur is finely serrate, as in the New Zealand species but more coarsely so, or in some specimens of *rufibase* and in *pertribuarium* the inner margin of the spur has only a few large oblique teeth.

The red metasoma of *ewarti*, *exoneuroides*, *rufibase*, and *pertribuarium* is suggestive of *Parasphecodes*. Except for their small body size and the weak second transverse cubital vein, these species could be regarded as belonging to *Parasphecodes*, and may be related to *Parasphecodes*, a thought that is further supported by the presence of short hairs on the eyes in these species. The discovery of the males should clarify this matter.

DISTRIBUTION: New Zealand, Victoria, southern Queensland, Western Australia.

INCLUDED SPECIES

- Lasioglossum (Austrevylaeus) ewarti* (Cockerell, 1910a) (*Halictus*) n. comb. (B.M.)
exoneuroides (Rayment, 1953a) (*Halictus*) n. comb. (C.S.I.R.O.)
huttoni (Cameron, 1900) (*Halictus*) n. comb. (B.M.) New Zealand
melanurum (Cockerell, 1919b) (*Halictus*) n. comb. (U.S.N.M.)
pertasmaniae (Rayment, 1953a) (*Halictus*) n. comb. (C.S.I.R.O.)
pertribuarium (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
rufibase (Cockerell, 1923) (*Halictus*) n. comb. (Q.M.)
smithii (Dalla Torre, 1896) (*Halictus*) n. comb. = *Halictus familiaris* Smith, 1876, not Erichson, 1841, not Smith, 1879 (B.M.) New Zealand
sordidum (Smith, 1853) (*Halictus*) n. comb. (B.M.) New Zealand

Lasioglossum pertasmaniae is nonmetallic, like other members of the subgenus, contrary to the original description.

SUBGENUS LASIOGLOSSUM CURTIS, SENSU STRICTO

Text figures 582-587

Lasioglossum CURTIS, 1833, p. 448. Type: *Lasioglossum tricingulum* Curtis, 1833 = *Melitta xanthopus* W. Kirby, 1802 (monobasic and original designation).

Pachyhalictus COCKERELL, 1928i, p. 589. Type: *Halictus merescens* Cockerell, 1919 (original designation).

In this group are placed a few species the relationships of which are not directly with *Chilalictus*, but rather with an Indo-Malayan group of species which, at least until better understood, is best included in the subgenus *Lasioglossum* proper. In the subgeneric sense *Lasioglossum* has hitherto been used for a group of rather large holarctic species which in the Western Hemisphere extends south to Central America. It is now apparent that many, mostly moderate-sized, species of southern Asia can logically be included in this group and that at least one African species, *layardi* Cockerell, is also a member of it. It is not altogether logical, in view of the present status of our knowledge, to separate *Lasioglossum* from *Erylaeus*, which differs only by having the second transverse cubital vein of the female narrower than the first. This problem is not of concern in the Australian area, however, as *Erylaeus* is a holarctic group with species no closer to our area than Java.

Lasioglossum, *sensu stricto*, as it is represented in the Indo-Malayan and Australian areas, differs from *Erylaeus* and some northern *Lasioglossum*, *sensu stricto*, as well as from *Chilalictus*, by the dense pubescence of the metanotum in contrast to adjacent areas. This is to some degree true of the European *xanthopus*, the type species, but not of all the northern species of the subgenus. Other differentiating features of *Chilalictus* are discussed under that subgenus. It is quite possible that further study of the Asiatic fauna will show that *Pachyhalictus* should be recognized as a valid subgenus, differing from the holarctic *Lasioglossum* proper by the usually pectinate spur of the female and other characters.

Body of moderate to small size, not metallic, metasoma in some cases red; *process of labrum of female tapering to a point*, or in some cases (in forms outside our area) expanded but not so much so or in so complicated a way as is usual in *Chilalictus*; eyes bare or with scattered, exceedingly short hairs. Second transverse cubital vein strong; basitibial plate of female usually pointed, of male present; inner hind tibial spur of female pectinate or in some cases coarsely serrate. Metasomal terga often with basal bands or basilateral areas of tomentum; male genitalia with stylus less than half as long as gonocoxite,

ventroapical process of gonocoxite large.

Males have not been studied for any of the Australian species except *repertulum*¹; the above comments, where males are concerned, are based in part on Indian species. It is probable that a few of the species, especially perhaps *sturti* and others discussed in paragraph 2 below, having a spur of a different type than that of *Lasioglossum* proper, would be placed in another subgenus if males were known. Likewise those with pointed basitibial plates might be segregated if their males were better known.

Various species are grouped below in numbered paragraphs to indicate the variation within the subgenus:

1. *Stirlingi*: Eyes with scattered, exceedingly short hairs. Basitibial plate rounded; spur pectinate; metasomal basal bands of tomentum distinct. This species is closely allied to *L. merescens*, the type of *Pachyhalictus*, a Philippine species that belongs to an Indo-Malayan group. (See p. 338.)

2. *Sturti* and probably *cyclurum*: Basitibial plate pointed; spur with two to several short sharp teeth, thus coarsely serrate or almost pectinate, but not with blunt teeth such as result from reduction of pectinations (dorso-lateral angle of pronotum strong); no metasomal bands. *Lasioglossum blandulum* may have a similar spur, but the basitibial plate is short and not pointed.

3. *Repertulum*, *speculellum*, *expulsum*, *semipolatum*, *barretti*, and *picticornis*: Eyes bare. Basitibial plate rather pointed, spur pectinate; metasoma with weak basal bands of tomentum or basolateral areas (perhaps absent in *semipolatum*).

DISTRIBUTION: Holarctic Region, Central America, Africa, Indo-Malayan Region, Indonesia, New Guinea, and Australia from Queensland to Tasmania and Western Australia.

INCLUDED SPECIES

Lasioglossum (*Lasioglossum*) *amboinense* (Blüthgen, 1926) (*Halictus*) n. comb. (desc.) Ambon *barretti* (Cockerell, 1929a) (*Halictus*) n. comb. (A.M.N.H.)

¹ The male type of this species appears to have been dissected and the genitalia removed. However, they cannot now be found.

- blandulum* (Cockerell, 1929c) (*Halictus*) n. comb. (A.M.)
buruanum (Blüthgen, 1926) (*Halictus*) n. comb. (desc.) Buru
cattulum (Vachal, 1894) (*Halictus*) n. comb. (desc.) Southeast Asia to Buru and New Guinea (see Blüthgen, 1926)
cyclurum (Cockerell, 1915e) (*Halictus*) n. comb. (Q.M.)
expulsum (Cockerell, 1916e) (*Halictus*) n. comb. (U.S.N.M.)
globulare (Friese, 1924) (*Halictus*) n. comb. (desc.)
picticorne (Cockerell, 1930b) (*Halictus*) n. comb. (Q.M.)
repertulum (Cockerell, 1916d) (*Halictus*) n. comb. (U.S.N.M.)
semipoliolum (Cockerell, 1916d) (*Halictus*) n. comb. (U.S.N.M.)
speculellum (Cockerell, 1918b) (*Halictus*) n. comb. (Q.M.)
stirlingi (Cockerell, 1910a) (*Halictus*) n. comb. (B.M.)
sturti (Cockerell, 1906c) (*Halictus*) n. comb. (B.M.)
trizonulum (Friese, 1909) (*Halictus*) n. comb. (desc.) New Guinea

It is noteworthy that *stirlingi* belongs to the same small group of species as *vinctum* (Walker), *kalutarae* (Cockerell), and *reticulatum* (Dalla Torre) of Ceylon and India. Authentic material of the following additional Indo-Malayan species of this subgenus has been seen: *tamulicum* (Blüthgen), *semisculptum* (Cockerell), *sigiriellum* (Cockerell) (Ceylon); *deesanum* (Cameron), *clarum* (Nurse, not Cameron), *lahorensis* (Cameron), *nasicensis* (Cockerell), *speculithorax* (Cockerell), *matheranensis* (Cameron), *senescens* (Smith), *albescens* (Smith), *perhumile* (Cockerell), *salsettense* (Cockerell) (India); *miniokoense* (Cameron) (Laccadives); *insulare* (Blüthgen) (Tanimbar Island); *splendidulum* (Vachal) (Burma); *vagans* (Smith), *schmiedeknechti* (Friese) (Indonesia); *escholtziae* (Cockerell) (Philippine Islands).

GLOSSALICTUS, NEW SUBGENUS

Text figures 588-591, 623, 624

TYPE: *Halictus etheridgei* Cockerell, 1916.

This subgenus is proposed for a single species remarkable for the broad but simple labral process in the female and the long glossa of both sexes. The rather coarsely and

closely punctate body, including the metasoma, is also quite distinctive. The subgenus appears to be most closely related to *Lasioglossum*, *sensu stricto*, as suggested by the pectinate hind tibial spurs of the female which distinguish it clearly from *Chilalictus*.

Body of moderate size, not metallic; process of labrum of female broadly expanded laterally but margin not modified; glossa elongate, about three-fourths as long as prementum and two-thirds as long as face; eyes probably bare.¹ Second transverse cubital vein strong; basitibial plate of female pointed, of male present and pointed; inner hind tibial spur of female pectinate. Metasomal terga without basal bands or patches of tomentum; male genitalia with stylus more than half as long as gonocoxite, ventroapical process of gonocoxite a small hairy pad.

Noteworthy additional features of the male are as follows: labrum with a broad apical process, lacking a keel; head much broader than long; antenna reaching posterior end of tegula, middle flagellar segments about one and one-third times as long as broad.

DISTRIBUTION: Western Australia.

INCLUDED SPECIES

Lasioglossum (*Glossalictus*) *etheridgei* (Cockerell, 1916b) (*Halictus*) n. comb. (B.M.)

SUBGENUS NESOHALICTUS CRAWFORD

Text figures 625-627

Nesohalictus CRAWFORD, 1910, p. 120. Type: *Halictus robbii* Crawford, 1910 = *Andrena halictoides* Smith, 1869 (monobasic and original description).

This subgenus contains a moderate-sized species with an unusually long glossa, as indicated in the key to subgenera. The peculiar scopa (see key to subgenera) and the comb on the anterior basitarsis of the female are probably adaptations to collecting pollen from some particular plant, probably one with very coarse pollen such as *Hibiscus*.

¹ Only one specimen of each sex has been available for study, the holotype female of *etheridgei* and a male of the same species from Albany, Western Australia, January 18, 1935 (K. R. Norris), in the collection of the Commonwealth Scientific and Industrial Research Organization. Possibly the eyes have very sparse, very short hairs as in some other groups.

Body of moderate size, not metallic; process of labrum of female tapering to blunt point, with high keel apically; *glossa* more than one and one-half times as long as head; *clypeus* protuberant and produced so that more than half of its length is below lower ends of eyes. Second cubital vein strong; *anterior basitarsus* of female with comb of closely placed hairs along outer margin; eyes bare or with a few exceedingly short hairs; basitibial plate of female broad, bluntly pointed, of male present; inner hind tibial spur of female pectinate with two large teeth. Metasomal terga with basal bands (or in male basilateral patches) of pale tomentum; male genitalia with stylus bifid, more than half as long as gonocoxite; ventroapical process of gonocoxite long, projecting downward rather than basally as in many groups.

DISTRIBUTION: Southeast Asia to Taiwan, Philippine Islands, Indonesia, New Guinea.

INCLUDED SPECIES

Lasioglossum (*Nesohalictus*) *biroi* Friese, 1909 (*Halictus*) n. comb. New Guinea. According to Blüthgen (1926, 1930) this is the same as the widespread *halictoides* (Smith) which has various other synonyms also

CHILALICTUS, NEW SUBGENUS

Plate 13, figures 10-12; plate 14, figures 1-4; text figures 592-602, 621, 622

TYPE: *Halictus subinclinans* Cockerell, 1915.

This subgenus is the Australian equivalent of *Lasioglossum*, *sensu stricto*, of the Northern Hemisphere, which enters our area only to a minor extent. It agrees with *Lasioglossum* proper in the strong second transverse cubital vein, in having the inner hind tibial spur not finely serrate (see below), in having basal bands of tomentum on the metasomal terga in most species, and in the general aspect of the larger species. *Chilalictus* consists of species which, on the average, are smaller than *Lasioglossum* proper, some of them ranging down to the size of the smallest *Lasioglossum*, *sensu lato*. Some of these small forms are metallic green in coloration. *Chilalictus* constitutes a rather distinctive and unified subgenus, as shown, for example, by the relatively uniform type of male genitalia, with very long and nearly straight gonostyli. How-

ever, except for this character, which may lose some of its significance when genitalia of more Asiatic species are examined, there is no single feature which will invariably separate *Chilalictus* from *Lasioglossum*, *sensu stricto*. However, a number of features separate the majority of species from those of *Lasioglossum* proper. These features are as follows:

Process of labrum of female not tapering throughout its length to a point, but broad and modified as described below. [In a few *Lasioglossum*, *sensu stricto*, the labral process is somewhat expanded or with a projection on each side (as in *xanthopus*) but it is never so modified as in most species of *Chilalictus*.] *Inner hind tibial spur of female usually with large submedian tooth followed by wavy margin* (in *Lasioglossum*, *sensu stricto*, it is serrate or pectinate); *male with second recurrent and third transverse cubital veins narrower than preceding veins.* (In males of *Lasioglossum*, *sensu stricto*, these veins are as strong as the preceding veins or essentially so. This is true also of males of a few species of *Chilalictus* such as *supralucens*, *baudini*, and *repertum*, and is nearly true of *pachycephalum*. Additional exceptions to the above italicized statements are discussed after the description.)

Without examination of the genitalia it is occasionally difficult to separate with certainty large males of *Chilalictus* from those of *Australictus* and, if one ignores metasomal bands, from those of other subgenera allied to *Parasphecodes*. In *Chilalictus* males there are almost always defined basitibial plates, while these are never present in males of *Parasphecodes* and its allies. However, in a few males of *Chilalictus* such as *bassi*, *blighi*, *forticorne*, and *boweni*, such plates are absent.

The labrum of the female provides fine specific characters and should be illustrated for every species.

Body of rather large size to small, usually nonmetallic, metasoma rarely red, body weakly metallic or even bright green in a few small species. *Process of labrum of female broad*, rounded or truncate apically or notched on each side of median keel, margins often pectinate or with lateral elevations in addition to median keel; eyes usually bare but with rather abundant and fairly long hairs in *lanarium* and *calophyllae*. Second transverse cubital vein strong; basitibial

plate short in female and rounded apically, in male usually present; *inner hind tibial spur of female with one large tooth followed by a wavy, feebly coarsely serrate, or even straight margin*, the basal tooth very much reduced in a few species such as *helichrysi* and *pulvitetum* so that spur is only feebly coarsely serrate or in *seductum* almost simple; metasomal terga commonly with basal bands of pale tomentum or lateral basal areas with some pale tomentum, such vestiture absent from some small males and a few small females such as those of *mundulum* and *nigropolitum*; male genitalia with long, slender, nearly straight styli as well as large ventro-apical gonocoxal processes.

The following species have unusual features as indicated:

Lasioglossum furnauxi has the inner hind tibial spur almost pectinate and the basitibial plate pointed, but the labral process is as usual in *Chilalictus*. When the male is known, the characters of the species should be re-evaluated to determine whether it should remain in *Chilalictus* or perhaps be placed in *Lasioglossum*, *sensu stricto*.

Lasioglossum mesembryanthemi often, but not always and not always on both sides of the body, has the spur with a short tooth beyond the large one, so that it is nearly pectinate. The same is probably true of *mediopolitum* and *mesembryanthemellum*, or perhaps the more pectinate spur is of regular occurrence in one or both of these.

Lasioglossum pulvitetum and *helichrysi* have the spur almost pectinate; otherwise they seem typical for *Chilalictus*.

The gonostyli of the male are unusually short in *idoneum*, being less than half as long as the gonocoxites. This character suggests species of *Lasioglossum*, *sensu stricto*; *idoneum* does not have other features of that group. Unfortunately its female is unknown or unrecognized.

It is interesting that in most major groups of *Lasioglossum* species occur of which the males more or less approach the form of the females, having short antennae and short bodies. This is true of *mesembryanthemellum* and some other Australian species.

The metallic forms (marked *a* in the list) are all small and in coloration superficially resemble species of *Homalictus*. All degrees of

metallic coloration occur; for example, *L. nigropurpureum* is only very weakly metallic.

DISTRIBUTION: Tasmania, New Caledonia, and Australia north to northern Queensland and northwest Australia.

INCLUDED SPECIES

- Lasioglossum* (*Chilalictus*) *alboguttatum* (Friese, 1924) (*Halictus*) n. comb. ("typus" A.M.N.H.)
anexoneuroides (Rayment, 1953a) (*Halictus*) n. comb. (C.S.I.R.O.)
aptum (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
asperithorax (Cockerell, 1910h) (*Halictus*) n. comb. (B.M.)
(a) *atrocyaneum* (Cockerell, 1918b) (*Halictus*) n. comb. (U.S.N.M.)
(a?) *basilucens* (Cockerell, 1923) (*Halictus*) n. comb. (Q.M.) (not or scarcely metallic)
bassi (Cockerell, 1915e) (*Halictus*) n. comb. (B.M.)
baudini (Cockerell, 1915e) (*Halictus*) n. comb. (B.M.)
bicingulatum (Smith, 1853) (*Halictus*) n. comb.
blighi (Cockerell, 1915e) (*Halictus*) n. comb. (B.M.)
boweni (Cockerell, 1915e) (*Halictus*) n. comb. (B.M.)
brazieri (Cockerell, 1916e) (*Halictus*) n. comb. (B.M.)
bursariae (Cockerell, 1916d) (*Halictus*) n. comb. (C.S.I.R.O.)
calophyllae (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
cabbagei (Cockerell, 1910a) (*Halictus*) n. comb. (syntype U.S.N.M.)
cephalochilum Michener, new species (C.S.I.R.O.)
chapmani (Cockerell, 1910h) (*Halictus*) n. comb. (Berlin*)
circumdatum (Cockerell, 1914d) (*Halictus*) n. comb. (B.M.)
clariventre (Friese, 1924) (*Halictus*) n. comb. ("typus" A.M.N.H.)
?clelandi (Cockerell, 1910h) (*Halictus*) n. comb. (Berlin*)
(a) *cognatum* (Smith, 1853) (*Halictus*) n. comb. (B.M.)
colonicum (Rayment, 1953a) (*Halictus*) n. comb. (C.S.I.R.O.)
confusellum (Cockerell, 1916e) (*Halictus*) n. comb. (B.M.)
conspicuum (Smith, 1879) (*Halictus*) n. comb. (B.M.)
convexum (Smith, 1879) (*Halictus*) n. comb. (B.M.)

- cyclognathum* (Cockerell, 1914d) (*Halictus*)
n. comb. (C.S.I.R.O.)
- darwiniellum* (Cockerell, 1932b) (*Halictus*)
n. comb. (desc. Ox.)
- dimorphum* (Rayment, 1955a) (*Halictus*)
n. comb. *nomen nudum* (C.S.I.R.O.)
- disclusum* (Cockerell, 1914k) (*Halictus*) n.
comb. (B.M.)
- dolichocerum* (Cockerell, 1916e) (*Halictus*)
n. comb. (U.S.N.M.)
- (a) *dorsicyaneum* (Cockerell, 1930b) (*Halictus*)
n. comb. (U.S.N.M.)
- (a) *doweri* (Rayment, 1935)¹ (*Halictus*) n.
comb. (C.S.I.R.O.)
- eboracense* (Cockerell, 1918b) (*Halictus*) n.
comb. (B.M.)
- elliottii* (Rayment, 1929c) (*Halictus*) n.
comb. (N.M.V.)
- emeraldense* (Rayment, 1936) (*Halictus*) n.
comb. (C.S.I.R.O.)
- (a) *erythrurum* (Cockerell, 1914d) (*Halictus*)
n. comb. (U.S.N.M.)
- euryurum* (Cockerell, 1930b) (*Halictus*) n.
comb. (Q.M.)
- evasum* (Cockerell, 1930b) (*Halictus*) n.
comb. (Q.M.)
- exceptum* (Cockerell, 1930b) (*Halictus*) n.
comb. (Q.M.)
- excusum* (Cockerell, 1930b) (*Halictus*) n.
comb. (B.M.)
- expansifrons* (Cockerell, 1914d) (*Halictus*)
n. comb. (B.M.)
- ?*familiale* (Erichson, 1842) (*Hylaeus*) n.
comb. (desc.)
- festivum* (Rayment, 1935) (*Halictus*) n.
comb. (C.S.I.R.O.)
- (a) *florale* (Smith, 1853) (*Halictus*) n. comb.
(B.M.)
- forticorne* (Cockerell, 1916e) (*Halictus*) n.
comb. (B.M.)
- furneauxi* (Cockerell, 1915e) (*Halictus*) n.
comb. (B.M.)
- gilesi* (Cockerell, 1905i) (*Halictus*) n. comb.
(B.M.)
- gippsii* (Rayment, 1935) (*Halictus*) n.
comb. (C.S.I.R.O.)
- (a) *glauerti* (Rayment, 1931b) (*Halictus*) n.
comb. (C.S.I.R.O.)
- globosum* (Smith, 1853) (*Halictus*) n. comb.
(B.M.)
- goraeense* (Rayment, 1953a) (*Halictus*) n.
comb. (C.S.I.R.O.)
- granulithorax* (Cockerell, 1914d) (*Halictus*)
n. comb. (B.M.)
- (a) *greavessi* (Rayment, 1930a) (*Halictus*) n.
comb. (C.S.I.R.O.)
- griseovittatum* (Cockerell, 1914d) (*Halictus*)
n. comb. (U.S.N.M.)
- (a) *gunbowerense* (Rayment, 1939) (*Halictus*)
n. comb. (C.S.I.R.O.)
- gynochilum* Michener, new species
(C.S.I.R.O.)
- haematopus* (Cockerell, 1914m) (*Halictus*)
n. comb. (B.M.)
- (a) *haematostoma* (Cockerell, 1914d) (*Halictus*)
n. comb. (U.S.N.M.)
- helichrysi* (Cockerell, 1914d) (*Halictus*) n.
comb. (Q.M.)
- (a) *hemichalceum* (Cockerell, 1923) (*Halictus*)
n. comb. (Q.M.)
- humei* (Cockerell, 1905i) (*Halictus*) n.
comb. (B.M.)
- idoneum* (Cockerell, 1914d) (*Halictus*) n.
comb. (type series, U.S.N.M.)
- imitans* (Cockerell, 1914d) (*Halictus*) n.
comb. (B.M.)
- (a) *inclinans* (Smith, 1879) (*Halictus*) n. comb.
(B.M.)
- ?*infimum* (Erichson, 1842) (*Andrena*) n.
comb. (desc.)
- infrahirtum* (Cockerell, 1920) (*Parasphe-*
codes) n. comb. (U.S.N.M.)
- instabilis* (Cockerell, 1914d) (*Halictus*) n.
comb. (U.S.N.M.)
- intermedius* (Rayment, 1927d) (*Halictus*)
figures only. Not *Halictus intermedius*
Schenck, 1870
- isthmale* (Cockerell, 1914h) (*Halictus*) n.
comb. (B.M.)
- lanariellum* (Cockerell, 1916e) (*Halictus*)
n. comb. (B.M.)
- lanarium* (Smith, 1853) (*Halictus*) n. comb.
(B.M.)
- languinosum* (Smith, 1879) (*Halictus*) n.
comb. (B.M.)
- leai* (Cockerell, 1910a) (*Halictus*) n. comb.
(B.M.)
- litleri* (Cockerell, 1914m) (*Halictus*) n.
comb. (U.S.N.M.)
- (a) *luctificum* (Cockerell, 1930b) (*Halictus*) n.
comb. (C.S.I.R.O.)
- (a) *mackayense* (Friese, 1924) (*Halictus*) n.
comb. (desc.)
- macrops* (Cockerell, 1916e) (*Halictus*) n.
comb. (B.M.)
- maiusculum* (Rayment, 1930a) (*Halictus*)
n. comb. (C.S.I.R.O.)
- mediopolitum* (Cockerell, 1914d) (*Halictus*)
n. comb. (U.S.N.M.)

¹ The data on the "type" do not agree with those given by Rayment, nor does the specimen agree with the description. Placement is therefore doubtful, especially since the description is somewhat suggestive of a *Homalictus*.

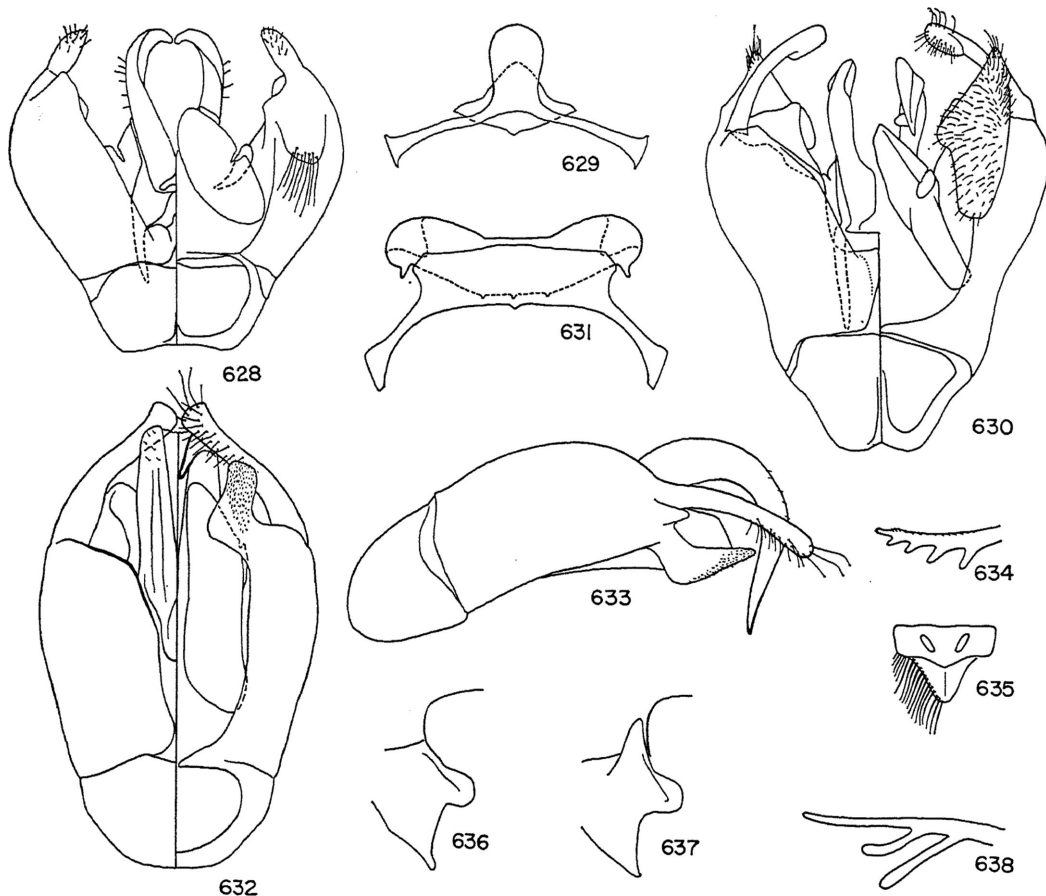
- melanopterum* (Cockerell, 1914k) (*Halictus*) n. comb. (B.M.)
- mesembryanthemi* (Cockerell, 1926d) (*Halictus*) n. comb. (U.S.N.M.)
- mesembryanthemiellum* (Rayment, 1935) (*Halictus*) n. comb. (N.M.V.)
- micridoneum* (Cockerell, 1930b) (*Halictus*) n. comb. (Q.M.)
- milleri* (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
- mirandum* (Cockerell, 1914e) (*Halictus*) n. comb. (B.M.)
- mittelli* (Cockerell, 1906c) (*Halictus*) n. comb. (B.M.)
- mjobergi* (Friese, 1917) (*Halictus*) n. comb. (desc.)
- moreense* (Cockerell, 1930b) (*Halictus*) n. comb. (Q.M.)
- (a) *mundulum* (Cockerell, 1916e) (*Halictus*) n. comb. (B.M.)
- nigropolium* (Cockerell, 1929a) (*Halictus*) n. comb. (B.M.)
- (a) *nigropurpureum* (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
- nudum* (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
- oblutum* (Smith, 1879) (*Halictus*) n. comb. (B.M.)
- obscuripes* (Friese, 1924) (*Halictus*) n. comb. (desc.). Preoccupied by Friese, 1916; not renamed because not recognized by me
- obscurissimum* Michener, new species (C.S.I.R.O.)
- omnivagum* (Rayment, 1935) (*Halictus*) n. comb. (cotype, Wilson)
- opacicolle* (Cockerell, 1914d) (*Halictus*) n. comb. (B.M.)
- orbatum* (Smith, 1853) (*Halictus*) n. comb.
- (a) *ornatum* (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
- pachycephalum* (Cockerell, 1916e) (*Halictus*) n. comb. (B.M.)
- percingulatum* (Rayment, 1935) (*Halictus*) n. comb. (desc.)
- platycephalum* (Rayment, 1927b) (*Halictus*) n. comb. (C.S.I.R.O.)
- plebeium* (Cockerell, 1914d) (*Halictus*) n. comb. (B.M.)
- polygoni* (Cockerell, 1929g) (*Halictus*) n. comb. (U.S.N.M.) New Caledonia
- pulvilectum* (Cockerell, 1915e) (*Halictus*) n. comb. (B.M.)
- (a) *purnongense* (Cockerell, 1913e) (*Halictus*) n. comb. (U.S.N.M.)
- repertum* (Cockerell, 1914d) (*Halictus*) n. comb. (B.M.)
- repraesentans* (Smith, 1853) (*Halictus*) n. comb. (B.M.)
- (a) *rufotinctum* (Cockerell, 1915d) (*Halictus*) n. comb. (Q.M.)
- sanguinipes* (Cockerell, 1914d) (*Halictus*) n. comb. (U.S.N.M.)
- sculpturatum* (Cockerell, 1930b) (*Halictus*) n. comb. (Q.M.)
- seductum* (Cockerell, 1914d) (*Halictus*) n. comb. (B.M.)
- semitens* (Cockerell, 1929c) (*Halictus*) n. comb. (A.M.)
- spenceri* (Cockerell, 1916e) (*Halictus*) n. comb. (B.M.)
- (a) *suberythrurum* (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
- subetheridgei* (Rayment, 1953a) (*Halictus*) n. comb. (C.S.I.R.O.)
- (a) *subinclinans* (Cockerell, 1915d) (*Halictus*) n. comb. (U.S.N.M.)
- subplebeium* (Cockerell, 1930b) (*Halictus*) n. comb. (Q.M.)
- supralucens* (Cockerell, 1916e) (*Halictus*) n. comb. (B.M.)
- tamburinei* (Friese, 1917) (*Halictus*) n. comb. ("typus" A.M.N.H.)
- tasmaniae* (Cockerell, 1905c) (*Sphecodes*) n. comb. (B.M.)
- veronicae* (Cockerell, 1926b) (*Halictus*) n. comb. (U.S.N.M.)
- (a) *victoriae* (Cockerell, 1926d) (*Halictus*) n. comb. (C.S.I.R.O.)
- victoriellum* (Cockerell, 1914d) (*Halictus*) n. comb. (B.M.)
- viridarii* (Cockerell, 1930b) (*Halictus*) n. comb. (Q.M.)
- (a) *vitripenne* (Smith, 1879) (*Halictus*) n. comb. (B.M.)
- (a) *vividum* (Smith, 1879) (*Halictus*) n. comb. (B.M.)
- wahlenbergiae* Michener, new species (C.S.I.R.O.)
- (a) *whiteleyi* (Rayment, 1939) (*Halictus*) n. comb. (C.S.I.R.O.)
- willsi* (Cockerell, 1906c) (*Halictus*) n. comb. (B.M.)

Halictus oxleyi Cockerell, described as a relative of species of *Chilalictus*, is in reality a *Euryglossa*, as shown by an examination of the type.

GENUS HOMALICTUS COCKERELL

Plate 14, figures 8-10, 12; text figures 603-608, 628-633, 636

Homalictus COCKERELL, 1919e, p. 13. Type: *Halictus taclobanensis* Cockerell, 1915 (original designation).



FIGS. 628-638. Halictinae. 628, 629. Male genitalia and attached seventh and eighth sterna of *Homalictus ctenander*. 630, 631. Same of *H. dampieri*. 632, 633. Genitalia of *H. szentivanyi*. 634, 635. Inner hind tibial spur and labrum of female of *Echthralictus extraordinarius*. 636, 637. Side view of pronotum and front of scutum of females of *Homalictus urbanus* and *Echthralictus extraordinarius*. 638. Inner hind tibial spur of female of *Nomioides perditella*.

Indohalictus BLÜTHGEN, 1931, p. 291. Type: *Halictus buccinus* Vachal, 1894 (original designation).

This large group is here accorded generic rank since it is believed to be abundantly distinct from the *Halictus-Lasioglossum* complex. The females can readily be recognized by the somewhat flattened metasoma and its very long ventral scopa, as described below. Males have distinctive genitalia, with the gonobase more or less continuing the contours of the coxites rather than broadly expanded as in *Lasioglossum*.

Small species, metallic in nearly all females and most males (body of female nonmetallic black in *blackburni*, *crinatus*, *cassiae-floris*,

and *luteipes*, and nearly so in several others), metasoma in some cases red, entire body testaceous in *rowlandi*. Labral process of female tapering to a point, its keel commonly depressed and broad above so that it appears to be merely the dorsal surface of apical part of process; lower parts of paraocular area of female usually with black, shining, and in some cases depressed area next to eye margin; eyes bare, in *tricolor* with sparse, very short hairs, at least in some specimens. Second transverse cubital vein strong; basitibial plate of female short, rounded or rarely slightly angulate, anterior margin of plate in some cases weak or absent (e.g., *flindersi*); basitibial plate of male present, in some

cases anterior margin not defined, rarely (*callaspis*) plate absent; inner hind tibial spur of female pectinate or at least with one large tooth. Metasoma without bands of tomentum; metasoma of female somewhat flattened, *terga strongly folded under at sides so that ventral portions are almost always separated from dorsal ones by a noticeable angle; metasomal scopa of conspicuously long, coarsely plumose hairs directed posteromesially, arising on ventral parts of terga, and of similar sternal hairs directed posteroventrally*; male genitalia with gonobase not so large and laterally expanded as in *Lasioglossum*.

The species here included in *Homalictus* have in the past (see Krombein, 1951) been divided into two subgenera (*Indohalictus* and *Homalictus*) on the basis of the following features: Frontal carina absent; ventroapical process of male gonocoxite large, gonostyli long—*Indohalictus*. Frontal carina present; ventroapical process of male genitalia small or absent, gonostyli short and small—*Homalictus*. I believe that these may be two phylogenetically distinct groups which perhaps deserve subgeneric recognition. I have not recognized them, however, for practical reasons. In some species almost certainly of the *Homalictus* group the frontal carina is almost invisible (e.g., *littoralis*, *oxoniellus*). In *semiplacatus*, although there is a frontal carina, there is also a long but slender ventroapical gonocoxal process. In most species only one sex is known. For these reasons it is most difficult to place some species in one or the other of these subgenera. The black shiny space at the lower ends of the inner orbits is variable in size in both groups and does not serve as a good character. Species believed to fall in the relatively small group *Indohalictus* are marked *a* in the following list, while those definitely of the *Homalictus* group are marked with a *b*. Doubtful species are unmarked. In the majority of cases placement is based only on the frontal carina.

Homalictus ctenander is unusual for the large, laterally produced, and upwardly lobate dorsolateral angles of the pronotum, the enormous head with the clypeus of the male more than five times as broad as long, that of the female nearly four times as broad as long, and for the pectinate inner hind tibial spur of the male. As noted in the description

of the species, *H. ctenander* has many similarities to *Ecthralictus*. The inner hind tibial spurs of males of *Homalictus* vary widely from being minutely toothed in most species, more coarsely toothed in species such as *tannaensis*, to pectinate in *perpersicius* and *ctenander*. A special subgenus for *ctenander* could be justified. (See p. 338.)

DISTRIBUTION: Tasmania, Australia, New Guinea (where the largest and most unusual species, such as *tricolor*, occur), Indonesia, India, Ceylon, the Philippine Islands, and eastward across the Pacific, being known from the Marianas, Guam, Caroline Islands, Rota, Solomon Islands, New Hebrides, New Caledonia, Loyalty Islands, Fiji, and Samoa. The center of abundance is in Australia.

INCLUDED SPECIES

- Homalictus* (b) *aponi* (Cheesman and Perkins, 1939) (*Halictus*) n. comb. (B.M.) New Hebrides
appositus (Rayment, 1939) (*Halictus*) n. comb. (C.S.I.R.O.)
areolatus (Friese, 1909) (*Halictus*) n. comb. ("typus" W.) New Guinea
(b) *aureoazureus* (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
(b) *baudinensis* (Cockerell, 1905d) (*Halictus*) n. comb. (B.M.)
(b) *behri* (Cockerell, 1910a) (*Halictus*) n. comb. (B.M.)
(a) *blackburni* (Cockerell, 1910a) (*Halictus*) n. comb. (B.M.)
(b) *botanicus* (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
bremerensis (Rayment, 1931b) (*Halictus*) n. comb. (W.A.M.)
(a) *brisbanensis* (Cockerell, 1918b) (*Halictus*) n. comb. (U.S.N.M.)
(b) *burkei* (Cockerell, 1906c) (*Halictus*) n. comb. (B.M.)
buruensis (Blüthgen, 1926) (*Halictus*) n. comb. (desc.) Buru
(b) *callaspis* (Cockerell, 1915d) (*Halictus*) n. comb. (type series, Q.M.)
(b) *caloundrensis* (Cockerell, 1914d) (*Halictus*) n. comb. (Q.M.)
(a) *cassiaefloris* (Cockerell, 1914d) (*Halictus*) n. comb. (B.M.)
(b) *claripes* (Friese, 1924) (*Halictus*) n. comb. ("typus" A.M.N.H.)
(b) *codenticalis* (Rayment, 1935) (*Halictus*) n. comb. = *occidentalis* Rayment, 1930a, not Cresson, 1872 (C.S.I.R.O.)
(b) *cretinicolus* (Friese, 1909) (*Halictus*) n. comb. ("typus" W.) New Guinea

- (a) *crinitus* (Friese, 1924) (*Halictus*) n. comb. ("typus" A.M.N.H.)
crotalariae (Cockerell, 1929g) (*Halictus*) n. comb. (desc.) New Caledonia
- (b) *ctenander* Michener, new species (Burns, N.M.V.)
- (a) *dampieri* (Cockerell, 1905h) (*Halictus*) n. comb. (B.M.)
- (b) *darwinensis* (Cockerell, 1929a) (*Halictus*) n. comb. (A.M.N.H.)
- (b) *demissus* (Cockerell, 1916e) (*Halictus*) n. comb. (U.S.N.M.)
- (b) *dixonii* (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
- (b) *dotatus* (Cockerell, 1912c) (*Halictus*) n. comb. (U.S.N.M.)
- (b) *epiensis* (Cockerell, 1916e) (*Halictus*) n. comb. (B.M.) New Hebrides
- (b) *errromanganus* (Cheesman and Perkins, 1939) (*Halictus*) n. comb. New Hebrides
- (a?) *eurhodopus* (Cockerell, 1914d) (*Halictus*) n. comb. (B.M.)
- (b) *exlautus* (Cockerell, 1905c) (*Halictus*) n. comb. (B.M.)
- (b) *exterus* (Cockerell, 1911b) (*Halictus*) n. comb. Solomon Islands
- (b) *eyrei* (Cockerell, 1910a) (*Halictus*) n. comb. (B.M.)
- (b) *fijiensis* (Perkins and Cheesman, 1928) (*Halictus*) n. comb. (B.M.) Fiji
- (b) *flindersi* (Cockerell, 1905h) (*Halictus*) n. comb. (B.M.)
- (b) *formosulus* Michener, new name for *Halictus formosus* Rayment, 1930a, Jour. Roy. Soc. Western Australia, vol. 16, p. 52, not *Halictus formosus* Dours, 1872 (C.S.-I.R.O.)
- (b) *froggatti* (Cockerell, 1911b) (*Halictus*) n. comb. Solomon Islands
- (b) *hackeriellus* (Cockerell, 1914d) (*Halictus*) n. comb. (type series, Q.M., U.S.N.M.)
- (b) *hedleyi* (Cockerell, 1910a) (*Halictus*) n. comb. (Berlin*)
- (a) *hentyi* (Rayment, 1953a) (*Halictus*) n. comb. (C.S.I.R.O.)
- hilli* (Cockerell, 1929a) (*Halictus*) n. comb. (A.M.N.H.)
- (b) *holochlorus* (Cockerell, 1914d) (*Halictus*) n. comb. (C.S.I.R.O.)
- (b) *humiliformis* (Cockerell, 1922a) (*Halictus*) n. comb. (Q.M.)
- (b) *humilis* (Smith, 1879) (*Halictus*) n. comb. (B.M.)
- (a) *indigoteus* (Friese, 1924) (*Halictus*) n. comb. (desc.)
- (b) *kestevenii* (Cockerell, 1912c) (*Halictus*) n. comb. (B.M.)
- latitarsis* (Friese, 1909) (*Halictus*) n. comb. ("typus" W.) New Guinea
- (b) *lavoroensis* (Cockerell, 1929c) (*Halictus*) n. comb. (A.M.) Solomon Islands
- (b) *leucurus* (Cockerell, 1914h) (*Halictus*) n. comb. (Q.M.)
- (b) *limatiformis* (Cockerell, 1922a) (*Halictus*) n. comb. (Q.M.)
- (b) *limatus* (Smith, 1853) (*Halictus*) n. comb. (B.M.)
- (b) *littoralis* (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
- (b) *lomatiae* (Cockerell, 1922a) (*Halictus*) n. comb. (Q.M.)
- (a) *lorentzi* (Friese, 1911b)¹ (*Nomia*) n. comb. (M.L.*) New Guinea
- (a) *luteipes* (Friese, 1909) (*Halictus*) n. comb. ("typus" W.) New Guinea
- (b) *luteoaeus* (Friese, 1924) (*Halictus*) n. comb. ("typus" A.M.N.H.)
- (b) *mackieae* (Cockerell, 1929h) (*Halictus*) n. comb. (A.M.N.H.) Samoa
- mailandi* (Cockerell, 1910a) (*Halictus*) n. comb. (B.M.)
- megastigmus* (Cockerell, 1926b) (*Halictus*) n. comb. (N.M.V.). Possibly incorrectly placed; type should be re-examined
- mesocyaneus* (Cockerell, 1922a) (*Halictus*) n. comb. (Q.M.)
- (b) *microchalcus* (Cockerell, 1929a) (*Halictus*) n. comb. (C.S.I.R.O.)
- (b) *murrayi* (Cockerell, 1905h) (*Halictus*) n. comb. (B.M.)
- (b) *niveifrons* (Cockerell, 1914d) (*Halictus*) n. comb. (B.M.)
- olivinus* (Cockerell, 1922a) (*Halictus*) n. comb. (Q.M.). Male only, not dissected; possibly incorrectly placed
- (b) *ounuensis* (Cheesman and Perkins, 1939) (*Halictus*) n. comb. (B.M.) New Hebrides
- (b) *oxoniellus* (Cockerell, 1914h) (*Halictus*) n. comb. (U.S.N.M.)
- (b) *pallidifrons* (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
- papuarum* (Cockerell, 1910a) (*Halictus*) n. comb. (Berlin*) New Guinea
- (b) *pavonellus* (Cockerell, 1915d) (*Halictus*) n. comb. (U.S.N.M.)
- (b) *perpessicus* (Kohl, 1908) (*Halictus*) n. comb. (cotype series W.) Samoa
- (b) *phillipensis* (Rayment, 1935) (*Halictus*) n. comb. (cotype, B.M.). The supposed type of this species (C.S.I.R.O.) does not agree with the original description in characters or collecting data and is

¹ I am indebted to Dr. M. A. Lieftinck for information on this species.

- similar to *Lasioglossum* (*Parasphecodes*) *clarigaster*
- (b) *portlandicus* (Rayment, 1953a) (*Halictus*) n. comb. (C.S.I.R.O.)
- (b) *pseudexterus* (Krombein, 1951) (*Halictus*) n. comb. (U.S.N.M.) Solomon Islands
- (b) *punctatus* (Smith, 1879) (*Halictus*) n. comb. (B.M.)
- purpureus* (Rayment, 1935, bottom of p. 695) (*Halictus*) n. comb.
- ralunicolus* (Friese, 1909) (*Halictus*) n. comb. ("typus" W.) New Britain
- (b) *raymenti* (Cockerell, 1926d) (*Halictus*) n. comb. (U.S.N.M.)
- (b) *risbeci* (Cockerell, 1929g) (*Halictus*) n. comb. (U.S.N.M.) New Caledonia
- (b) *rowlandi* (Cockerell, 1910a) (*Halictus*) n. comb. (B.M.)
- rufoaeneus* (Friese, 1924) (*Halictus*) n. comb. (desc.)
- (b) *samoae* (Perkins and Cheesman, 1928) (*Halictus*) n. comb. (B.M.) Samoa
- (b) *savaiiensis* (Perkins and Cheesman, 1928) (*Halictus*) n. comb. (B.M.) Samoa
- (b) *saycei* (Cockerell, 1912c) (*Halictus*) n. comb. (B.M.)
- (b) *scrupulosus* (Cockerell, 1930b) (*Halictus*) n. comb. (Q.M.)
- (b) *semicyaneus* (Cockerell, 1929e) (*Halictus*) n. comb. = *Halictus mesocyaneus* Cockerell, 1929h, not 1922a (A.M.N.H.) Samoa
- sevillensis* (Rayment, 1953a) (*Halictus*) n. comb. (C.S.I.R.O.)
- (b) *sphecodoides* (Smith, 1853) (*Halictus*) n. comb. (B.M.)
- (b) *sphecodopsis* (Cockerell, 1905c) (*Halictus*) n. comb. (B.M.)
- (b) *stradbokensis* (Cockerell, 1916e) (*Halictus*) n. comb. (U.S.N.M.)
- (a) *strangulatus* (Friese, 1924) (*Halictus*) n. comb. ("typus" A.M.N.H.)
- (b) *subcarus* (Cockerell, 1930a) (*Halictus*) n. comb. (M.C.Z.)
- subexterus* (Cockerell, 1939) (*Halictus*) n. comb. (Bishop) Solomon Islands
- (b) *subpallidifrons* (Rayment, 1935) (*Halictus*) n. comb. (C.S.I.R.O.)
- (b) *suburbanus* (Cockerell, 1930b) (*Halictus*) n. comb. (Q.M.)
- (b) *suvaensis* (Cockerell, 1929h) (*Halictus*) n. comb. (U.S.N.M.) Fiji
- szentivanyi* (Michener, 1960a) (*Halictus*) n. comb. (Bishop) New Guinea
- (b) *tannaensis* (Cockerell, 1916e) (*Halictus*) n. comb. (B.M.) New Hebrides
- (b) *tarltoni* (Cockerell, 1927) (*Halictus*) n. comb. (U.S.N.M.)
- (b) *tatei* (Cockerell, 1910a) (*Halictus*) n. comb. (B.M.)
- (a) *tenuis* (Friese, 1924) (*Halictus*) n. comb. Preoccupied by Ellis, 1913; not replaced since it is said to be a synonym of *cassiaeifloris*
- (b) *thor* (Cockerell, 1929a) (*Halictus*) n. comb. (U.S.N.M.)
- (b) *tonganus* (Perkins and Cheesman, 1928) (*Halictus*) n. comb. (B.M.) Tonga
- toxopei* (Alfken, 1926) (*Halictus*) n. comb. = *Halictus toxopeusi* Blüthgen, 1926 (unnecessary emendation) (desc.) Buru
- (a) *tricolor* Michener, new species (B.M.) New Guinea
- (b) *transvolans* (Cockerell, 1912c) (*Halictus*) n. comb. (B.M.)
- (b) *tutuila* (Perkins and Cheesman, 1928) (*Halictus*) n. comb. (B.M.) Samoa
- (b) *upoluensis* (Perkins and Cheesman, 1928) (*Halictus*) n. comb. (B.M.) Samoa
- (b) *urbanus* (Smith, 1879) (*Halictus*) n. comb. (B.M.)
- (b) *versifrons* (Perkins and Cheesman, 1928) (*Halictus*) n. comb. (B.M.) Fiji
- viridiniiensis* (Friese, 1924) (*Halictus*) n. comb. (desc.)
- (b) *viridiscitus* (Cockerell, 1911b) (*Halictus*) n. comb. (U.S.N.M.) Solomon Islands
- (b) *williamsi* (Cockerell, 1930a) (*Halictus*) n. comb. (M.C.Z.)
- (b) *wilsoni* (Cheesman and Perkins, 1939) (*Halictus*) n. comb. (B.M.) New Hebrides
- (b) *woodsi* (Cockerell, 1910a) (*Halictus*) n. comb. (B.M.)
- (b) *zachlorus* (Cockerell, 1929h) (*Halictus*) n. comb. (A.M.N.H.) Samoa
- (a) *zingowli* (Cheesman and Perkins, 1939) (*Halictus*) n. comb. (B.M.) New Hebrides

From outside our area, I have examined authentic material of *H. singhalensis* (Blüthgen) (Ceylon); *swezeyi* (Cockerell), *saffordi* (Cockerell) (Guam); *palauensis* (Cockerell), *yapensis* (Cockerell), *carolinensis* (Yasumatsu) (Caroline Islands); *taclobanensis* (Cockerell), *adomidae* (Cockerell), *caroli* (Cockerell), *pervarians* (Cockerell) (Philippine Islands); *dolorosus* (Blüthgen) (Java); and various other species listed by Krombein (1950) from Micronesia. All these species are new combinations in *Homalictus*.

GENUS *ECHTHRALICTUS* PERKINS AND CHEESMAN

Plate 14, figure 11; text figures 634, 635, 637

Echthralictus PERKINS AND CHEESMAN, 1928, p. 14. Type: *Halictus extraordinarius* Kohl, 1908 (original designation).

This genus is a parasitic derivative of *Homalictus* in the strict sense (not of *Indohalictus*), as is shown by the presence of a frontal carina, by the metallic coloration, by the presence of a few very long, simple, sternal hairs in the female (remnants of the sternal scopa), and by the form of the male genitalia. Although it does not exhibit the coarse punctation of *Sphecodes*, it does show some other features no doubt related to parasitic life, such as the long simple mandibles of the female, the lack of the keel on the labral process, lack of the pedal scopa and near lack of the sternal one, and the reduced gradulus of the sixth tergum of the female, not forming a distinct plate basal to the pygidial plate. In numerous features it is less specialized as a parasite than *Sphecodes*. For example, it retains basitibial plates, pectinate inner hind tibial spurs (both sexes), and a reduced and broadened but evident area on the fifth tergum of the female, surrounded by the prepygidial fringe.

Body small, metallic. Process of labrum broad, tapering, apex rounded; clypeus of female nearly three (*latro*) to about four (*extraordinarius*) times as broad as long, of male more than twice as broad as long; eyes bare. Dorsolateral angles of pronotum strongly produced upward and strongly acute; second transverse cubital vein strong; basitibial plates of both sexes rather large, rounded apically; inner hind tibial spur of female pectinate. Metasomal terga without bands of tomentum; metasoma of female not much flattened, and margins not angulate as in *Homalictus*; male genitalia as in *Homalictus* in the narrow sense, gonostyli short, ventro-apical process of gonocoxite absent.

DISTRIBUTION: Samoa.

INCLUDED SPECIES

- Echthralictus extraordinarius* (Kohl, 1908) (*Halictus*) (cotype W.) Samoa
latro Perkins and Cheesman, 1928 (B.M.) Samoa
stevensoni (Cockerell, 1924) (*Halictus*) (U.S.-N.M.) Samoa

There are at least two different species in Samoa. Because of the lack of a scopa, they are presumed to be social parasites in the nests of *Homalictus*. The similarity to *Homalictus ctenander* of Australia is probably

parallelism; it seems likely that *Echthralictus* arose in the islands where it is now found.

GENUS SPHECODES LATREILLE

Sphecodes LATREILLE, 1804, p. 182. Type: *Nomada gibba* Fabricius, 1804 = *Sphex gibba* Linnaeus, 1758 (monobasic).

The rather numerous synonymous and subgeneric names are not listed here; most of them were listed by Michener (1944).

This genus differs from most other Halictinae of our area by the lack of a scopa in the female, of a longitudinal keel on the labral process of the female, and by having all the veins of the distal part of the wing equally strong instead of having the second transverse cubital and second recurrent veins weaker than the rest. The basitibial plates in the female are represented by rather slender, slightly elevated, shining areas but are not defined by carinae. The head and thorax are coarsely punctured and black, the metasoma shining and red in most species. The tibial spurs of the female are ciliate.

Sphecodes consists of social parasites unable to provision their own nests. Elsewhere in the world most species are parasitic in nests of halictine bees.

I have made no effort to study the groupings and possible subgenera of *Sphecodes*, and a subgeneric assignment is indicated only for *ralunensis*.

DISTRIBUTION: All continents; uncommon only in Australia where there are but two species, known only from Queensland, but one of them reaching the southern part of that state. Known also from Indonesia and New Guinea.

INCLUDED SPECIES

- Sphecodes amboinensis* Meyer, 1924 (desc.) Ambon
biroi Friese, 1909 New Guinea. This is not *biroi* Meyer, 1924 = *duplex* Blüthgen, 1925
manskii (Rayment, 1935) (*Mellitidia*) n. comb. (C.S.I.R.O.)
profugus Cockerell, 1910a (B.M.)

The first two names listed above are said by Blüthgen (1927) to represent a single species which ranges as far as the Philippine Islands and Malaya. All our species except *manskii* are nonmetallic, black, with the metasoma largely red. *Sphecodes manskii* is wholly black, with very dark wings, and is

unusually large (11.5 mm. long); it therefore has an appearance unusual for the genus and probably is not parasitic on halictine bees as are most *Sphecodes* of other continents. Possibly it inhabits nests of *Nomia*. It must be noted that some of the characters listed by Rayment for *manskii* are partly imaginative. The metasoma, at least now, is not metallic. The labral pubescence is not especially unusual; it is true that there are some hooked hairs but there are many that are straight. Contrary to the figure, the basal vein is curved as in other *Sphecodes*. See the note on *manskii* under *Callosphcodes*.

SUBGENUS CALLOSPHCODES FRIESE

Callosphcodes FRIESE, 1909, p. 182. Type: *Callosphcodes ralunensis* Friese, 1909 (monobasic).

The subgenus is known from one specimen from the Bismarck Archipelago which is said to agree with *Sphecodes* except for the steel blue metasoma.

INCLUDED SPECIES

Sphecodes (*Callosphcodes*) *ralunensis* Friese, 1909 (desc.) New Britain¹

I suspect that *S. manskii* from northern Queensland may belong to the same group as *ralunensis*. The metasoma was described as metallic by Rayment (1935), although it is not now metallic in the type.

GENUS NOMIOIDES SCHENCK

Text figure 638

Nomioides SCHENCK, 1866, p. 333. Type: *Andrena pulchella* Jurine, 1807 = *Apis minutissima* Rossi, 1790 (monobasic).

Ceylalictus STRAND, 1913, p. 137. Type: *Halictus horni* Strand, 1913 (monobasic).

Cellaria FRIESE, 1913 (not Ellis and Solander, 1786), p. 575. Type: *Nomioides arnoldi* Friese, 1913 (monobasic).

Cellariella STRAND, 1926, p. 53. Type: *Nomioides arnoldi* Friese, 1913 (autobasic).

¹ Friese (1909) did not state which island this species came from but simply recorded it from Ralun, Bismarck Archipelago. Drs. J. L. Gressitt and J. J. H. Szent-Ivany both have kindly told me of places by such names as Ralum Village, Raluan Village and Headlands, and Raluana Village and Census Division. All are in the area of the Gazelle Peninsula, New Britain, which is probably the source of Friese's bee. Dr. M. A. Lief-tinck (*in litt.*) states that Friese's Ralun was an error for Ralum.

Eunomioides BLÜTHGEN, 1937, p. 3 (no description). Type: *Andrena variegata* Olivier, 1789 (original designation).

This is a genus of minute, usually yellow and greenish black bees. It differs strikingly from the other genera of the Halictinae in the absence of a median cleft or "furrow," fringed by hairs, on the dorsum of the fifth metasomal tergum of the female. The inner margins of the eyes are emarginate as in *Augochlora* and its relatives of the Western Hemisphere. The veins of the distal part of the wing are of equal thickness (the more distal transverse cubitals and recurrent not weaker as in most genera). The basitibial plates are present and the inner hind tibial spurs coarsely pectinate.

DISTRIBUTION: Southern Europe to South Africa, eastward to India, Malaya, Philippine Islands, Indonesia, and northern Australia, south to southern Queensland; occurs in northwest Australia. Not yet known from New Guinea.

INCLUDED SPECIES

Nomioides obliqua (Friese, 1924) (*Halictus*) *perditella* Cockerell, 1905b

The above specific names are probably synonymous, there being only one species in Australia.

FAMILY MELITTIDAE

This family has the type of mentum and submentum found in the long-tongued families but has short glossa and labial palpi as in the families Halictidae and Andrenidae. The Melittidae are a small family, represented by four subfamilies, only one of which, the Ctenoplectrinae, reaches our area.

SUBFAMILY CTENOPLECTRINAE

This subfamily contains only a single genus, *Ctenoplectra*.

GENUS CTENOPLECTRA W. KIRBY

Text figures 639, 640

Ctenoplectra W. KIRBY, in Kirby and Spence, 1826, p. 681. Type: *Ctenoplectra chalybea* SMITH, 1858, first included species and designated by Sandhouse, 1943, p. 542.

Ctenoplectra SMITH, 1858, p. 44. Type: *Ctenoplectra chalybea* SMITH, 1858 (monobasic).



FIGS. 639, 640. Melittidae. 639. Wings of *Ctenoplectra chalybea* (scale line represents 5 mm.). 640. Inner view of hind tibia and tarsus of female of same.

This strange genus can be distinguished from all other bees by the large, comblike, crescentic, inner hind tibial spur of the females. Ours are rather large species, with the metasoma deep blue. (See p. 338.)

Friese (1909) gives some information on the nesting of *C. chalybea* in New Guinea, as does Williams (1928) for a related species in the Philippines. Nests are made in abandoned burrows of beetles in wood.

DISTRIBUTION: South Africa to Abyssinia, southern Asia to China, Philippine Islands and Taiwan, south through Indonesia to the Moluccas, New Guinea, and northern Queensland.

INCLUDED SPECIES

Ctenoplectra australica Cockerell, 1926a (N.M.V.)
chalybea Smith, 1857 (Ox.) Burma to New Guinea

FAMILY MEGACHILIDAE

This is one of the most readily recognized families of bees because of the characteristic form, with a large head which is usually well developed in the genal and occipital regions. There are always two submarginal cells, with the second as long, or nearly as long, as the first. The scopa is on the metasomal sterna, not the legs (scopa absent from *Coelioxys* and *Parevaspis*). Basitibial and pygidial plates are absent or nearly so (except that males of *Lithurge* have a pygidial plate).

Bees of this family are noted for customarily using pre-existing burrows in making their nests, when they are in burrows at all (but some *Creightonella* and *Megachile* make their own burrows), and for the use of foreign material (leaves, leaf pulp, pebbles, resin, and

so on) in making the cell walls. The larvae spin strong cocoons before pupation.

KEY TO THE SUBFAMILIES OF THE MEGACHILIDAE

Jugal lobe of posterior wing about three-fourths as long as vannal lobe; hind tibia of female coarsely tuberculate on outer surface; male with pygidial plate, female with slender remnant thereof in the form of large spine, flattened dorsally *Lithurginae*
 Jugal lobe of posterior wings less than half as long as vannal lobe; tibiae not tuberculate or only anterior pair tuberculate; pygidial plate entirely absent *Megachilinae*

SUBFAMILY LITHURGINAE

Only one genus, *Lithurge*, is found in the Eastern Hemisphere.

GENUS LITHURGE LATREILLE

Lithurge LATREILLE, 1825, p. 463. Type: *Andrena cornuta* Fabricius, 1787 (monobasic).

Lithurgus BERTHOLD, 1827, p. 467 (emendation of *Lithurge*). Type: *Andrena cornuta* Fabricius, 1787 (autobasic and monobasic).

Members of this genus have the appearance of rather large, broad species of *Megachile* with the metasoma rather strongly flattened.

Species of the Eastern Hemisphere are probably largely or entirely restricted, in provisioning their nests, to pollen of large-flowered Malvaceae (e.g., *Hibiscus*, *Urena*); in North America they use the similarly coarse pollen of Cactaceae.

Nests known from our area are placed in burrows of beetles or other origin in old wood (Rayment, 1935; Lieftinck, 1939).

DISTRIBUTION: All continents. Species of our area belong to the subgenus *Lithurge*,

sensu stricto, found from South Africa to Europe, Asia, and Australia. American forms belong to other subgenera and genera (having arolia in the males) except for *huberi* of eastern Brazil which belongs to *Lithurge*, *sensu stricto*. These bees have an excellent ability to cross water barriers. The single species *scabrosus* ranges from India to Tahiti. In the following list original localities but not total distributions of non-Australian names are given. In our area the genus is found in New Guinea, the Bismarck Archipelago, Admiralty Islands, Solomon Islands, New Hebrides, New Caledonia, Fiji, Tonga, Samoa, Tahiti, Cook Islands, and Australia south to New South Wales and central Western Australia.

INCLUDED SPECIES

- Lithurge* (*Lithurge*) *albofimbriatus* Sichel, 1867
Tahiti
atriformis Cockerell, 1905c (B.M.)¹
atratus Smith, 1853 (B.M.) India, recorded from
New Guinea, Bismarcks, and elsewhere
bractipes Perkins and Cheesman, 1928, Samoa
cognatus Smith, 1868a (B.M.)
dentipes Smith, 1853 (desc., false type in B.M.)
fortis Cockerell, 1929c (A.M.) Solomon Islands
froggatti Cockerell, 1914i (U.S.N.M.) New
Hebrides
nigerrimus Krombein, 1949 (U.S.N.M.) Solomon
Islands
rubricatus Smith, 1853 (B.M.)
scabrosus (Smith, 1859b) (*Megachile*) (Ox.) Aru

Except for *cognatus* and *rubricatus*, the above names may represent a single species possibly carried, as nests in wood, from island to island by primitive men. Liefstinck has examined most of the types.

SUBFAMILY MEGACHILINAE

The great bulk of the Megachilidae fall in this subfamily.

KEY TO THE TRIBES OF THE MEGACHILINAE

- Arolia (in ours) present; stigma short so that distance from its base to vein r is little if any longer than width of stigma; claws of female with large median tooth or prong . . . Anthidiini
Arolia absent; stigma longer so that distance from base to vein r is much longer than width of

stigma; claws of female simple or with small basal tooth Megachilini

TRIBE MEGACHILINI

In our area this tribe is represented by the well known parasitic genus *Coelioxys* and by a large number of species hitherto usually placed together in the genus *Megachile*. Various authors have expressed the idea that *Megachile* (including such groups as *Chalicodoma* and *Gronoceras*) is a group of such enormous diversity in structure and nesting habits that it should be divided, and in fact European authors for many years have separated their species of *Chalicodoma* as a distinct genus, which it certainly appears to be when only the European fauna is considered. When faunas of other continents are examined, the gap between these *Chalicodoma* and *Megachile* is narrowed, so that the practice of naming some striking variants (e.g., *Thaumatoceras*, *Gronoceras*) and leaving the bulk of the species in *Megachile* has been followed in the African, Asiatic, and Australian faunas. It seems that a more worthwhile procedure is to attempt major divisions.

A seemingly important biological division is between those that make nests with pieces of leaves or petals and those that use resin, mud, leaf pulp, or other such material. It is not surprising that the mandibles of the female differ, those of the leafcutters having a sharp cutting edge in the interspace between the second and third teeth (second interspace) or in that between the third and fourth teeth (third interspace) or both. As such cutting edges are not found in other bees, their lack is presumably a primitive feature. It is therefore not unexpected to find other common megachiline features, not shared by the leafcutters, among those that do not cut leaves. For example, the body is relatively elongate and rather parallel sided in those that do not cut leaves. Such a body form is also found in some of the leafcutters, but the majority of them are broad, with the metasoma rather flattened. In the non-leafcutters, particularly the smaller ones, the posterior end of the scutellum is not strongly curved down but merely slopes, the metanotum is not vertical but slopes, and the basal part of the propodeum is subhorizontal instead of subvertical. These statements apply to no

¹ In addition to Australia, this species is found in Fiji, to which it was probably introduced (Cockerell, 1929a).

leafcutters. Again the characteristics of the non-leafcutters are more like those of other megachilines and are presumably more primitive. Finally, the characters of the metanotum, scutellar crest, and axillar fossa given in the key to the genera distinguish the two groups. It should be made clear that no one of these characters of the posterior end of the thorax, including those indicated in the key, holds perfectly; nonetheless, when one examines the posterior end of the thorax and considers the complex of features presented by it, one can tell whether to expect to find cutting edges on the mandibles of the female or not. There is an exception to the mandibular character in the subgenus *Chelostomoda*, yet I think we are dealing with two natural groups the distinctness of which is somewhat obscured by the amount of radiation that has occurred in each.

For the reasons outlined above it seems to me that it is practical and useful to distinguish two large groups in what has generally been called *Megachile*, and to use for these the names *Megachile* and *Chalicodoma*. Both of these genera are themselves diversified and worldwide in distribution (although *Chalicodoma* is represented, among the native species of the Western Hemisphere, by only two subgenera, *Chelostomoides* and *Stelodides*). An additional small group, *Creightonella*, seems to require generic rank.

The ideas presented above were also described in a preliminary paper by me (1962a).

KEY TO THE GENERA OF THE MEGACHILINI

1. Axilla produced posteriorly to a distinct tooth; posterior and dorsal surfaces of scutellum separated by distinct angle; metasoma conical, widest in first segment, tapering posteriorly; sixth metasomal segment of male provided with several long spines; scopa absent. *Coelioxys*
Axilla rounded; dorsal surface of scutellum rounding onto posterior surface; metasoma not conical; sixth metasomal segment of male not provided with long spines; sternal scopa present 2
2. Mandible of female with cutting edge in second or third interval between teeth or both (in second but not third interspace only in *Mitchellapis*); metasoma usually broad, more or less flattened and not parallel sided (except in *Mitchellapis* and *Creightonella*); metanotum fused to propodeum, in some

cases indistinguishably so, although usually with a weak line separating them; sublaterally, metanotum usually considerably narrowed, often only half as long sublaterally as medially; postalar fossa shallow, surface behind it subhorizontal, no high crest between it and metanotum; eighth metasomal sternum of male bare or with short discal hairs, without marginal hairs (except in *Mitchellapis* and *Creightonella*) 3

- Mandible of female without cutting edges between teeth (except in *Chelostomoda*, which has one in second interspace only); metasoma strongly convex dorsally, more or less parallel sided; metanotum separated from propodeum by a suture which is often as conspicuous as scutellar-metanotal suture (except in *Chalicodomoidea*); sublaterally metanotum usually but little narrowed; postalar fossa deep, its posterior face usually ascending to distinct crest between it and metanotum; eighth metasomal sternum of male with marginal hairs . . . *Chalicodoma*
3. Male with six exposed sterna (sixth in some cases largely hidden); mandible of female with six teeth; second, third, and fourth interspaces each with incomplete cutting edge of similar shape, that of fourth interspace small and inconspicuous from front; metasoma parallel sided, ours with pubescence usually almost wholly black and without metasomal fasciae . . . *Creightonella*
Male with four exposed sterna; mandibles of female four-toothed except in some Pacific island species of *Eutricharaea* which have five teeth, cutting edges in second and third interspaces only, these edges usually of markedly different shapes or one of them absent; metasoma broad, not parallel sided (except in *Mitchellapis*), usually with much pale hair which commonly forms metasomal fasciae *Megachile*

SPECIES OF THE MEGACHILINI NOT PLACED IN THE PRESENT CLASSIFICATION

(Probable generic placements are indicated in brackets; all species were described in the genus *Megachile*. Presumably none belongs to the genus *Coelioxys*.)

acutiventris Friese, 1903b (desc.) New Guinea
adelaidae Cockerell, 1910i (desc. Berlin*) [*Megachile*]

amboinensis Friese, 1909 = *Megachile rufa* Friese, 1903b, not 1903a, p. 276. Not from our area in spite of name

aurantiaca Friese, 1905b (desc.) New Caledonia
castaneipes Friese, 1908 (desc.) [*Megachile*]

fusca Friese, 1903b (desc.) Kai

mertoni Friese, 1909 (desc.) Kai [*Megachile*]
quodi Vachal, 1907 (desc.) New Caledonia [*Chalicodoma*]
subatrella Rayment, 1939 (desc.)
swarbrecki Rayment, 1946b (desc.) [*Megachile*]
taua Strand, 1911b (desc.) New Guinea [*Megachile*]
toxopei Alfken, 1926 (desc.) Buru [*Megachile*]

GENUS CHALICODOMA LEPELETIER

Plate 15, figures 1-3; text figures 641-718

Chalicodoma LEPELETIER, 1841, p. 309. Type: *Apis muraria* Retzius, 1783 (designation of Girard, 1879, p. 778).

This name is here used in a completely new sense (see also Michener, 1962a) to include the species of *Megachile*, *sensu lato*, that do not cut leaves (and possibly a few that do).

The following group names, representing groups absent from our area, have been applied to forms falling in *Chalicodoma* as here defined: *Archimegachile* Alfken, 1933; *Chalicodoma* Lepeletier, 1841, *sensu stricto*; *Chelostomoides* Robertson, 1903 (= *Oligotropus* Robertson, 1903; *Gnathodon* Robertson, 1903; and *Sarogaster* Robertson, 1918); *Digronoceras* Cockerell, 1931; *Maximegachile* Guiglia and Pasteels, 1961; *Gronoceras* Cockerell, 1907; *Pseudomegachile* Friese, 1898; and *Stelodides* Moure, 1953.

Of the subgenera, the Australian *Hackeriapis* is perhaps the most variable, and others might all reasonably have been derived from it, except that *Eumegachilana* probably arose from *Callomegachile*.

The bees of this genus make nests of resin (Hacker, 1915; Rayment, 1954b), beeswax (Rayment, 1935), chewed paper or leaf pulp (Rayment, 1955b; 1956b), or mud (at least in other areas). In Appendix 2 nests of *C. concolor* and *C. kuehni* are briefly described. Nests are placed in small cavities such as holes in stems and logs, spaces under bark, and cells in abandoned wasp nests.

KEY TO THE SUBGENERA OF *Chalicodoma* OF THE AUSTRALIAN REGION

1. First sternum of both sexes with large mid-apical spine; carina of sixth tergum of male very high and weakly crenulate to serrate medially, usually not emarginate, abruptly disappearing laterally *Austrochile*
 First sternum at most apically tuberculate; carina of sixth tergum of male low (rarely

even absent), not toothed, medially slightly emarginate (except in *Rhodomegachile* and a few others) 2

2. Claws each with two teeth on under side (fig. 698); proboscis of female closed posteriorly by a process from lower side of each genal area; hind tibial spurs of male absent; sixth metasomal sternum of male divided into two lateral sclerites by broad, median, membranous region (fig. 659) *Schizomegachile*

Claws without or with but one ventral tooth each; proboscis of female open posteriorly; hind tibial spurs of male present (at least one); sixth metasomal sternum of male continuous, not divided into lateral hemisternites 3

3. Males 4
 Females 11

4. With three exposed sterna or in some cases rear margin of the fourth exposed.¹ . . . 5
 With four more or less fully exposed sterna¹ 8

5. Carina of sixth tergum reduced to short, non-emarginate ridge or absent; metasomal integument red, without strong postgradular grooves on terga 2 and 3; glossa broad, ligulate *Rhodomegachile*

Carina of sixth tergum evident, in almost every case medially emarginate [merely an emarginate swelling, not carinate, in *C. (Hackeriapis) cliffordi*; a scarcely emarginate ridge in *C. (H.) appositula*]; metasomal integument usually black, if red, with strong transverse grooves on second and third terga; glossa linear, rarely somewhat broadened 6

6. Distance between apices of first and third mandibular teeth nearly equal to distance from third tooth to base of mandible; apex of first metasomal sternum produced as a broad, nearly hairless, median, suberect flap; large robust species; metasoma without indications of pale tergal bands *Chalicodomoides*

Distance between first and third (or second if mandible only bidentate) mandibular teeth much less than distance from basal tooth to base of mandible; apex of first metasomal sternum not as above; usually smaller and more slender species; metasoma usually

¹ In some cases, owing to artificial straightening of the metasoma, sterna that are ordinarily not or but little exposed become broadly exposed. Exposed sterna are usually punctate and hairy in a manner rather similar to one another whereas hidden sterna are more delicate, less punctate, with shorter and often flattened or otherwise modified hairs.

- with indications of pale tergal hair bands 7
7. Region of carina of sixth tergum swollen except at median emargination. (Rare, northern Australia and northward.) *Chelostomoda*
Region of carina of sixth tergum not swollen. (Common throughout Australia and Tasmania, rare in New Guinea, not known elsewhere.) *Hackeriapis*
8. Only one hind tibial spur; clypeus with a group of coarse, quill-like bristles arising near middle; flagellum exceedingly attenuate, first segment longer than others, last two segments expanded *Thaumatosoma*
Two hind tibial spurs; clypeus without such bristles; flagellum rarely attenuate, last segment rarely expanded, first segment shorter than second 9
9. Scutum and lower part of mesepisternum with areas in which punctures are arranged in rows to produce a striate appearance; fifth and sixth sterna (in ours) delicate, without large capitate or otherwise specialized hairs. [Large or moderate-sized species, pubescence all black or often with areas of brilliant fulvous (not confined to apex of metasoma) or conspicuous white.] *Callomegachile*
Scutum and mesepisternum with punctures not arranged in rows (except in one species of *Hackeriapis*); fifth and sixth sterna thicker, at least sixth with areas of specialized, usually capitate hairs 10
10. First and second terga without deep transverse postgradular grooves; pubescence all black or with pale or other areas not forming metasomal bands; length 18 mm. or more; posterior margin of sixth tergum without teeth *Eumegachilana*
Terga with or without deep postgradular grooves; pubescence usually giving a gray appearance, in some cases fulvous on metasoma, usually forming metasomal bands; length usually less than 18 mm.; posterior margin of sixth tergum almost invariably with four teeth, median ones in some cases absent *Hackeriapis*
11. Mandible with distinct cutting edge in second interspace; sterna with white apical hair bands beneath scopa *Chelostomoda*
Mandible without cutting edge; sterna without apical hair bands (except in *atrella*, a *Hackeriapis*). 12
12. Metasomal integument red; second and third terga without deep transverse postgradular grooves; glossa broad, ligulate (fig. 716) *Rhodomegachile*
Metasomal integument black or, if red, with deep postgradular grooves; glossa linear or only slightly broadened 13
13. Metasomal terga 2 and 3 usually with deep transverse postgradular grooves, these absent from some middle-sized and large species in which claws have strong basal tooth (except in *semiluctuosa*); pubescence usually giving a gray aspect, often forming apical white tergal fasciae; fulvous pubescence often present but confined to apical part of metasoma, rarely (*ustulata*) metasoma with extensive fulvous pubescence *Hackeriapis* (and probably *Thaumatosoma*)
Metasomal terga without deep transverse postgradular grooves [except in *C. (Callomegachile) mcnamerae* and others from New Guinea northwestward]; claws without basal teeth; pubescence black, fulvous, or with white patches, not grayish in aspect and not forming tergal fasciae, fulvous pubescence if present not confined to apical part of metasoma 14
14. Mandible shining (although punctate), apical margin very oblique, as long as distance from basal tooth to base of mandible; sharp tooth behind base of mandible. *Chalicodomoides*
Mandible dull with minute roughening, apical margin shorter, no tooth behind base of mandible 15
15. Mandibles porrect, three (in ours) teeth across the narrow apex; thoracic punctures not in rows *Eumegachilana*
Mandibles (in ours) of the ordinary shape, four- or five-toothed; punctures of scutum and lower part of mesepisternum arranged in rows to produce a coarsely striate aspect *Callomegachile*

SUBGENUS CALLOMEGACHILE MICHENER

Plate 15, figure 1; text figures 641-644, 661-663

Callomegachile MICHENER, 1962a, p. 21. Type: *Chalicodoma mystaceana* Michener, 1962 (original designation).

This subgenus consists of a large group of Paletropical megachilids which usually have large, elongate bodies and striking coloration like those of *Creightonella* and subgenera of *Chalicodoma* such as *Maximegachile*, *Gronoceras*, and *Eumegachilana*. The species of this group, especially those (not in our area) having elongate porrect mandibles and a short

tumescens clypeus in the female, suggestive of those of *Eumegachilana*, have often been incorrectly placed in the subgenus *Eumegachile*, a Palearctic segregate of the genus *Megachile* proper (see Michener, 1962a). *Callomegachile* differs from other subgenera (except for the species *monstrosa* in *Hackeriapis*) by having the punctures of parts of the scutum and of the lower part of the mesepisternum arranged in rows so that a coarsely striate appearance is produced. Other important features are italicized in the following description. Species from our area have the mandible of the female broad (rather slender in *szentivanyi*) and four- or typically five-toothed and the hidden sterna of the male without capitate hairs, but these characters are variable among species from other regions.

Large or sometimes moderate-sized, body parallel sided; posterior part of thorax similar to that of *Chalicodoma*, *sensu stricto*; head much developed posteriorly, often with a preoccipital carina or distinct ridge; prothoracic lobe usually carinate. Metasoma parallel sided, occasionally (e.g., *mcnamerae*) with rather deep transverse grooves suggestive of *Chelostomoides* or *Hackreiapis*.

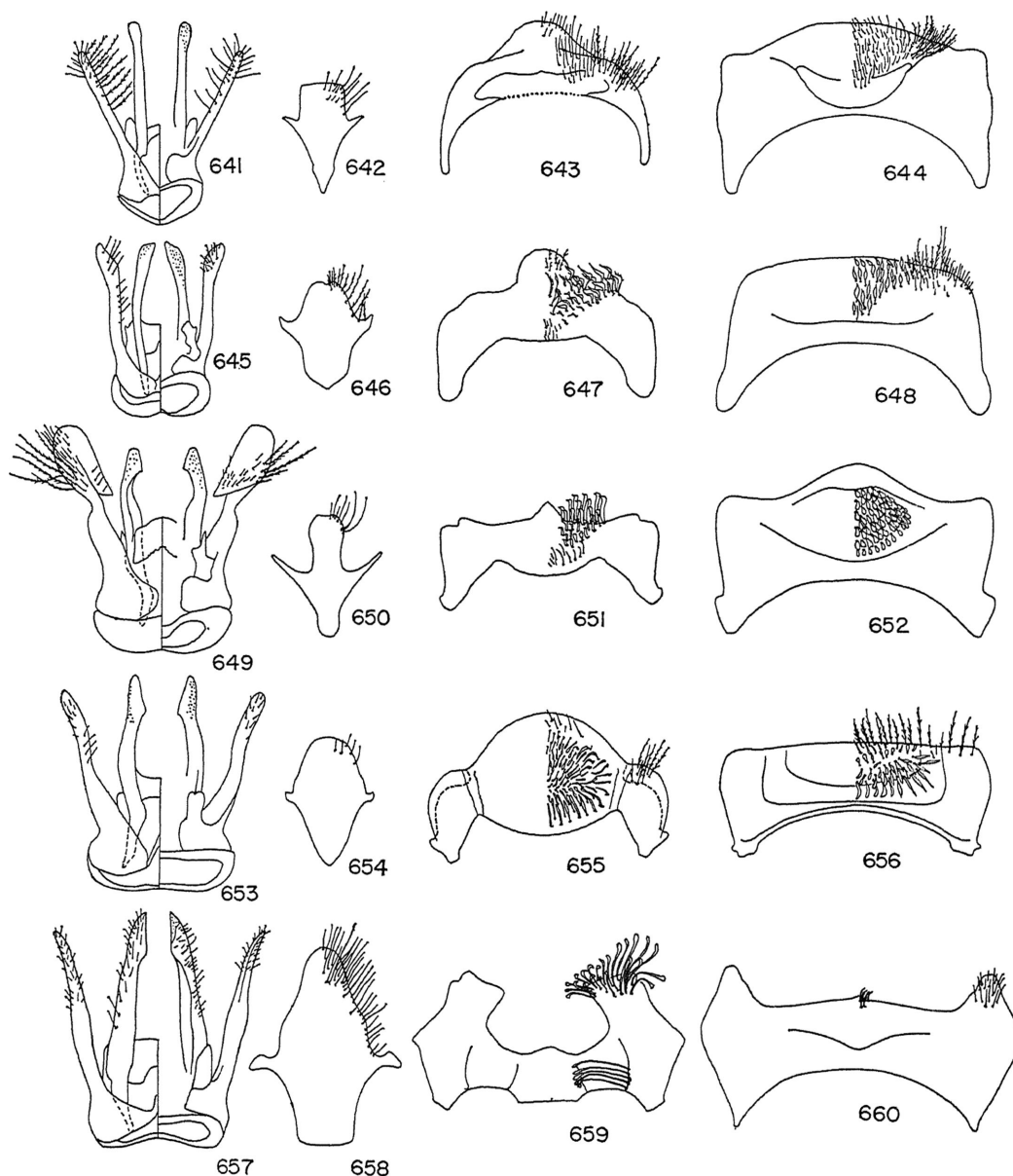
FEMALE: Mandible minutely roughened and dull, basal part shining in *szentivanyi*; mandibles in ours broad (rather slender in *szentivanyi*), four- or usually five-toothed, without cutting edge; clypeus in ours not protuberant; first flagellar segment broader than long and shorter than second. Basitarsi much shorter and much narrower than corresponding tibiae; *claws simple*; sixth tergum slightly concave in profile, sides straight seen from above, surface with short suberect hairs and tomentum as is found on other terga; terga without pubescent fasciae (except in certain exotic forms such as *cephalotes*); sixth sternum with scopal hairs throughout, no bare rim; sterna without apical pubescent bands.

MALE: Mandible tridentate, with median inferior swelling or projection (absent from some Asiatic and African forms), basal projection absent; first flagellar segment broader than long, much shorter than second. First coxa with apical spine, in some cases reduced to tubercle or absent, anterior surface with short or long hairs, no rufescent bristles; anterior tarsus not or slightly broadened; mid

tibial spur present, claws symmetrical; middle and hind basitarsi unmodified, slender, middle ones more than half as long as tibia, hind ones about half as long as tibia. *Carina of sixth tergum not much produced, a small weak emargination medially, a deep depression in tergum above center of carina, carina not toothed; margin of sixth tergum not toothed; four sterna exposed*; hidden sterna delicate, in ours without modified hairs; *gonocoxites slender, apices simple*.

Among African species, some agree well with the description given above, although some do not have the first flagellar segment so short as indicated. In several species the mandibles are porrect and the clypeus is short and usually tumescent, as in *Eumegachilana*. This situation is not true of *adjuta* (Cockerell) and *devexa* (Vachal), for example, but is true of such forms as *rufipes* (Fabricius), *chrysorrhoea* (Gerstaecker), and *punctolineata* (Cockerell), as well as the Indian *cephalotes* and others. At first I believed these to belong to a different subgenus or possibly to *Eumegachilana*, not only because of the mandibular and clypeal characters of the female but because the males have capitate hairs on the fifth and seventh sterna. However, there are intergradations in the mandibular and clypeal characters (e.g., *szentivanyi*) and Prof. J. Pasteels of Brussels has been good enough to point out that species such as *devexa* have short broad mandibles and an ordinary clypeus as in the *Callomegachile* of the Australian Region but have capitate hairs on the hidden sterna. Thus these characters seem to exist in various combinations and cannot well be used for the separation of groups; it is more important that the close relationships be indicated by retaining all these forms in a single subgenus.

Chalicodoma rugicollis and some others are remarkable for the extremely coarse sculpture, the striations of the scutum and mesepisternum being exaggerated to form large channels and ridges. *Chalicodoma mcnamerae*, *facetula*, *incisa*, *rotundiceps*, and *faceta* are also coarsely punctate but less strikingly so; there are strong postgradular grooves on the terga which are not densely pubescent; the scopal hairs are very coarse and blunt, in some capitate. *Chalicodoma rangii* differs from most in having a pitted zone across the base



FIGS. 641-660. Male genitalia and eighth, sixth, and fifth sterna of Megachilinae. 641-644. *Chalicodoma* (*Callomegachile*) *mystaceana*. 645-648. *C.* (*Eumegachilana*) *clotho*. 649-652. *C.* (*Chalicodomoides*) *aethiops*. 653-656. *C.* (*Hackeriapis*) *trichognatha*. 657-660. *C.* (*Schizomegachile*) *monstrosa*.

of the propodeum. In certain forms, such as *devexa* and *rugicollis*, a strong carina or lamella separates the anterior from the lateral face of the mesepisternum. In other species, such as *faceta* and *biroi*, this is indicated only on the lower part of the mesepisternum, while in still others it is completely lacking.

DISTRIBUTION: Africa, Ceylon, India, to China, Taiwan, Japan, Philippine Islands (introduced as far east as Hawaii), Malaya, Indonesia, New Guinea, Admiralty Islands, Bismarck Archipelago, Solomon Islands, New Hebrides, New Caledonia, Queensland (to southern border), Northern Territory.

INCLUDED SPECIES

- Chalicodoma* (*Callomegachile*) *albiceps* (Friese, 1903a) (*Megachile*) n. comb. (desc.) Gorong, between Seram and Kai
albobasalis (Smith, 1879) (*Megachile*) n. comb. (?B.M.)
auriceps (Meade-Waldo, 1914a) (*Megachile*) n. comb. (B.M.) New Guinea
biroi (Friese, 1903a) (*Megachile*) ("typus" W.)
carinifrons (Alfken, 1926) (*Megachile*) n. comb. Buru¹
cheesmanae Michener, new name for *Megachile elegans* Cheesman, 1938, Ann. Mag. Nat. Hist., ser. 11, vol. 1, p. 245, not Friese, 1923 (B.M.) New Guinea
cincturata (Cockerell, 1912b) (*Megachile*) n. comb. (U.S.N.M.)
clo (Friese, 1903b) (*Megachile*) n. comb. (desc.) Celebes, recorded perhaps by error from Halmahera in Friese's (1909) key
concolor (Friese, 1903a) (*Megachile*) n. comb. Kai
finschi (Friese, 1911d) (*Megachile*) n. comb. (desc.) New Guinea
funeraria (Smith, 1863) (*Megachile*) n. comb. (Ox.) Buru
herlei (Friese, 1911d) (*Megachile*) n. comb. New Guinea
kuehni (Friese, 1903a) (*Megachile*) n. comb. Misool
laboriosa (Smith, 1862b) (*Megachile*) n. comb. (Ox.) Ternate
lateritia (Smith, 1859b) (*Megachile*) n. comb. (Ox.) Aru
lorentzi (Friese, 1911b) (*Megachile*) n. comb. New Guinea
luteiceps (Friese, 1911d) (*Megachile*) n. comb. (desc.)
malayana (Cameron, 1901) (*Megachile*) n. comb. (B.M.) New Britain
mcnamerae (Cockerell, 1929c) (*Megachile*) (A.M.) New Guinea
mendanae (Cockerell, 1911b) (*Megachile*) n. comb. (C.S.I.R.O.) Solomon Islands
mortyana (Dalla Torre, 1896) (*Megachile*) n. comb. = *Megachile apicata* Smith, 1864, not 1853 (Ox.) Morotai
mystaceana Michener, 1962a (Q.M.)
nidulator (Smith, 1864) (*Megachile*) (Ox.) New Guinea
nitidiscutata (Friese, 1920) (*Megachile*) n. comb. (desc.)
pretiosa (Friese, 1909) (*Megachile*)
rambutwan (Cheesman, 1936) (*Megachile*) n. comb. (B.M.) New Hebrides, New Caledonia

- rangii* (Cheesman, 1936) (*Megachile*) n. comb. (B.M.) New Hebrides
regina (Cheesman, 1938) (*Megachile*) n. comb. (type series B.M.) New Guinea
szentivanyi Michener, new species (A.M.N.H.) New Britain
tertia (Dalla Torre, 1896) (*Megachile*) n. comb. = *Megachile senex* Smith, 1864, not 1853 or 1862 (B.M., Ox.) New Guinea
tomentosa (Friese, 1903b) (*Megachile*) n. comb. (H.N.M.) Kai
viridinitens (Cockerell, 1930a) (*Megachile*) n. comb. (M.C.Z.)

Some of the species from Asia and from nearer areas that are assigned to this subgenus are: *disjuncta* (Fabricius), *cephalotes* (Smith), *umbripennis* (Smith), *semivestita* Smith, *fulvipennis* (Smith) (India); *disjunctiformis* (Cockerell) (Taiwan); *davaonensis* (Cockerell) (Philippine Islands); *rugicollis* (Friese), *osea* (Cameron), *facetula* (Cockerell) (Borneo); *faceta* (Bingham) (Burma); *opposita* (Smith) (Java); *terminalis* (Smith), *aterrima* (Smith), and *incisa* (Smith) (Celebes).

EUMEGACHILANA, NEW SUBGENUS

Text figures 645-648, 664-666

TYPE: *Megachile clotho* Smith, 1861.

This subgenus includes the largest and most remarkable (for their enormous heads and jaws) of the species that have for many years been incorrectly placed in *Eumegachile* (see Michener, 1962a, and the discussion under *Callomegachile*). Indeed *Chalicodoma* (*Eumegachilana*) *pluto* is the largest bee in the world (39 mm. in length.) The subgenus *Eumegachilana* is related to *Callomegachile* but differs in the ordinarily greater size (females ordinarily 25 mm. long or longer, males 18 mm. or longer), in having the thoracic punctation not in rows (in some cases punctures grouped into foveae), and in the fine, shining, longitudinal line extending from the ocelli to the posterior margin of the vertex of the female. (A short, incomplete line of the same sort is sometimes found in *Callomegachile*.) In the one species of which the male is known to me (*clotho*), the apices of the gonocoxites are a little more expanded apically than in species of *Callomegachile* that I have examined. From species of *Callomegachile* found in our area, *Eumegachilana* further

¹ Subgeneric position indicated (*in litt.*) by Lieftinck.

differs by (1) the very elongate mandibles of the female (five or more times as long as minimum width), (2) the presence of only three apical mandibular teeth, (3) the enormous labrum of the female, with some of the large apical submarginal hairs composite (i.e., what appears to be a single very strong, long hair is in reality several hairs closely fitted together), (4) the eyes of the female, which diverge strongly below, and (5) the hidden sterna of the male which bear specialized, broad or capitate hairs, at least in *clotho*.

In some ways the species of *Eumegachilana* also resemble the African subgenus *Maximegachile*, which has similar large mandibles and a line from the ocelli to the posterior edge of the vertex in the female. However, *Maximegachile* has shiny rather than dull mandibles, broader male gonocoxites, and other features that suggest that it is not closely related to *Eumegachilana* and *Callomegachile*.

Large to gigantic, with body parallel sided; posterior part of thorax similar to that of *Chalicodoma*, *sensu stricto*; head much developed posteriorly, preoccipital carina present at least laterally; tooth often at rear of hypostomal carina.

FEMALE: Mandible minutely roughened and dull, much elongated, five or more times as long as shortest breadth, dentate apex short, with three teeth, no cutting edge; clypeus protuberant, not produced below, labrum exposed to base; first flagellar segment broader than long to longer than broad, shorter than second. Basitarsi much shorter than tibiae, middle one narrower, hind as broad as to much narrower than tibia, claws simple. Metasoma parallelsided; sixth tergum slightly concave seen in profile, sides about straight seen from above, surface not tomentose, with suberect hairs; sixth sternum with scopa, except in some cases on bare apical margin; sterna without apical hair bands.

MALE: Mandibles quadridentate, with small basal inferior projection; first flagellar segment broader than long, shorter than second. First coxa with anterior surface with short hairs and an apical spine, without rufescent bristles; anterior tarsi only slightly modified; middle tibial spur present; middle and hind basitarsi slender, unmodified, much shorter than corresponding tibiae; middle claws symmetrical. Carina of sixth tergum

moderately produced, an emargination in center, without teeth, a deep depression in tergum above center of carina; margin of sixth tergum without teeth; four sterna exposed; fifth and sixth metasomal sterna with patches of spatulate or capitate hairs; gonocoxites with apices simple but not so slender as in *Callomegachile*.

This subgenus is represented in Indonesia by *tuberculata* Smith and in the Himalayas, China, and Japan by *monticola* Smith. These species are similar to *clotho* in basic features. In *godeffroyi*, *ingens*, and *pluto* the basal inner mandibular tooth of the female is wanting or nearly so, and there are short, clawlike setae on the outer surfaces of the front and middle tibiae. In *sculpturalis* Smith (China, Japan, Taiwan) the apex of the mandible of the female has four teeth instead of three. When males become available, it may be evident that some of these species represent independent developments of the remarkable mandibular and facial structure of the female.

DISTRIBUTION: New Guinea, New Britain, New Ireland, Ternate, Batjan, Indonesia, to India, China, Taiwan, and Japan.

INCLUDED SPECIES

- Chalicodoma* (*Eumegachilana*) *clotho* (Smith, 1861) (*Megachile*) n. comb. (Ox.) New Guinea
gigantea (Friese, 1911d) (*Megachile*) n. comb. (desc.) Ternate
godeffroyi (Friese, 1911d) (*Megachile*) n. comb. New Britain
ingens (Friese, 1903b) (*Megachile*) n. comb. New Guinea
pluto (Smith, 1861) (*Megachile*) n. comb. Batjan

Dr. M. A. Lieftinck writes (*in litt.*) that there is definite evidence that the enormous mandibles and labrum of the females are correlated with the kind of flowers they visit. He saw *C. tuberculata* hanging in a vertical position on the flowers of *Crotalaria* (Leguminosae) and using the mandibles and labrum to spread the closed petals and release the stamens. Pollen gathering then occurred in a very brief period before the bee flew.

SUBGENUS CHALICODOMOIDES MICHENER

Plate 15, figure 2; text figures 649–652, 667–670

Chalicodomoides MICHENER, 1962a, p. 24. Type: *Megachile aethiops* Smith, 1853 (original designation).

This subgenus is known from one or perhaps two species for which four names are available. One of them, *aethiops* Smith, was described from Africa. It is, however, widely distributed in northern Australia. It is presumably a native in Australia; probably the African record was an error. In general appearance and in the unusually oblique apical margins of the mandibles, this subgenus resembles a sparsely hairy *Chalicodoma*, *sensu stricto*. It differs from that subgenus as well as from most others in having only three mandibular teeth in the female. It differs from other subgenera of large, dark-haired species by having only three exposed metasomal sterna in the male. It is, in spite of its appearance, close to *Hackeriapis*, particularly to species of group *b* of that subgenus, and *C. (Hackeriapis) fumipennis* shows a distinct approach toward *Chalicodomoides* both in appearance and clypeal and mandibular form.

Large, body parallel sided; posterior part of thorax similar to that of *Chalicodoma*, *sensu stricto*.

FEMALE: Mandible moderately shining, apical margin very oblique, about half as long as maximum mandibular length, with three small, widely separated teeth, no cutting edge; clypeus strongly produced over base of labrum; first flagellar segment as long as broad, shorter than second; small sharp tooth behind base of mandible. Basitarsi much shorter and somewhat narrower than corresponding tibiae; claws each with strong basal tooth. Metasoma robust and rather parallel sided; sixth tergum protruding midapically so that profile as well as lateral margins (seen from above) are concave; sixth sternum also produced midapically to form broad, weakly bilobed projection; scopal hairs present on base of sixth sternum, otherwise hairs confined to a large lateroapical fovea on each side; large triangular area between foveae and hairy base of sternum smooth and shining, this area continuous midapically with margin of apical projection which is also smooth and shining; sterna without apical hair bands.

MALE: Mandible tridentate, without inferior projection; first flagellar segment broader than long, shorter than second. Front coxa with anterior surface hairy, no apical spine or spicules; anterior tarsi slightly broadened; middle tibial spur present; middle and

hind basitarsi slender, unmodified, much shorter than corresponding tibiae; middle claws symmetrical. Carina of sixth tergum moderately produced, a strong emargination in center, not toothed, no deep depression in tergum; margin of sixth tergum not toothed, but tergum with small tooth at each side near margin which is probably the equivalent of usual marginal tooth; three exposed sterna; fifth and sixth sterna with patches of modified hairs; gonocoxites with apices broad, hairy.

DISTRIBUTION: Northern Australia from Queensland to Western Australia.

INCLUDED SPECIES

Chalicodoma (Chalicodomoides) aethiops (Smith, 1853) (*Megachile*) (B.M.)
clarki (Cockerell, 1914i) (*Megachile*) (U.S.N.M.)
doddiana (Cockerell, 1906b) (*Megachile*)
oppidalis (Cockerell, 1926a) (*Megachile*) n. comb. (N.M.V.)

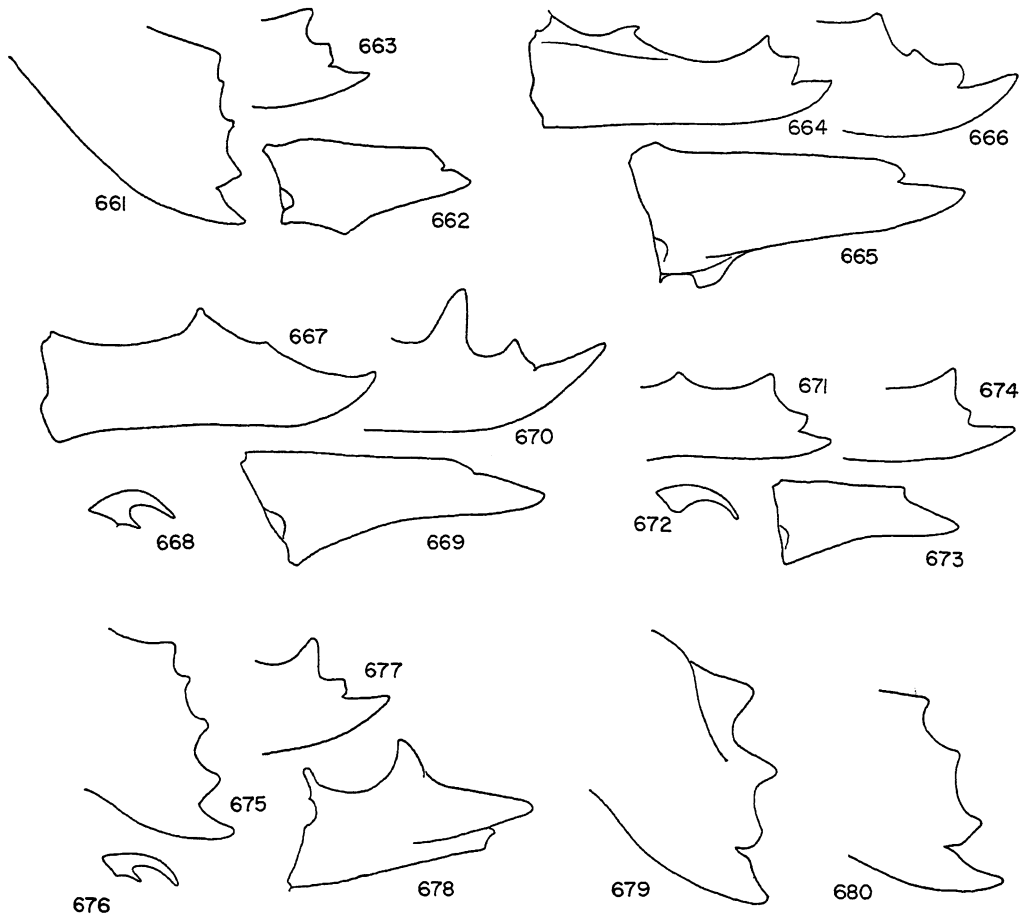
SUBGENUS HACKERIAPIS COCKERELL

Plate 15, figure 3; text figures 653-656, 671-680, 713

Hackeriapis COCKERELL, 1922c, p. 267. Type: *Megachile rhodura* Cockerell, 1906 (original designation).

This subgenus, the North and South American *Chelostomoides*, the primarily Oriental *Chelostomoda* (see below), and the monotypic *Thaumatosoma* constitute the small, heriadiiform¹ section of the genus. [An Indian species (*stulta* Bingham, *ramdara* Cockerell) is similar but probably belongs to none of the above-mentioned groups; it lacks transverse tergal grooves and has four exposed sterna in the male.] It is a remarkable fact that bees of this type should be so abundant in America and Australia, only sparsely represented and by strikingly different types in Asia, and seemingly absent from Africa. The American and Australian groups are very closely related and probably should be included in the same subgenus, which would be called *Chelostomoides* Robertson, 1901. In both regions these bees exhibit great structural diversity, and I was not able to find many characters that would separate them consistently. In the Australian *Hackeriapis*

¹ Form of *Heriades*, a genus that does not occur in Australia. These bees are small, parallel sided, cylindrical.



FIGS. 661-680. Megachilinae. 661-663. Mandible of female, outer side of mandible of male, and apex of mandible of male of *Chalicodoma* (*Callomegachile*) *mystaceana*. 664-666. Same of (*Eumegachilana*) *clotho*. 667-670. Mandible and claw of female, outer side of mandible of male, and apex of mandible of male of *C.* (*Chalicodomoides*) *aethiops*. 671-674. Same of *C.* (*Hackeriapis*) *derelicta*. 675-678. Same of *C.* (*H.*) *aurifrons*, 679, 680. Apices of mandibles of females of *C.* (*H.*) *axillaris* and *henrici*.

the postgradular grooves of the terga are not fasciate (see note on *subsericauda*), while in the American *Chelostomoides* they contain at least some pale hairs so that there are basal as well as (usually) apical bands of pale hairs. In many (but by no means all) Australian species the fifth sternum lacks specialized, capitate hairs; it has such hairs in all North American species except *georgica*. In some Australian species (in some, one sex only) the maxillary palpi are not bristly as they are in American ones.

The vast majority of *Hackeriapis* can be distinguished easily from other megachilids

of our area (except *Thaumatosoma* and *Chelostomoda*) by the strong transverse grooves of the second and third metasomal terga. Some of the larger species, however, lack these grooves or have them only weakly developed, and separation from *Callomegachile* becomes a problem. Some small *Hackeriapis* have a small tooth near the base of each claw, and all the large and confusing ones except *semiluctuosa* have a large or very large tooth in this position. From *Callomegachile* and *Eumegachilana* such teeth are absent. Except for *ustulata*, *Hackeriapis* are generally grayish bees because of pale or mixed pubescence over

black integument, and, if they have fulvous pubescence on the metasoma, it is confined to the apical part (again except in *ustulata*). (*Chalicodoma mackayensis* is quite black in appearance and has a striking fulvous area at the end of the metasoma.) In *Callomegachile* and *Eumegachilana* the color is black, fulvous, or black and white, or all three colors, owing to pubescence which rarely or never gives a grayish color to the head and thorax as it does in *Hackeriapis*. In *Callomegachile* and *Eumegachilana* the posterior margin of the sixth tergum of the male is not toothed; it has lateral and usually median teeth (often weak) in *Hackeriapis*.

The mandibles of the females of *Callomegachile* and *Eumegachilana* are minutely roughened and dull; they are shining although irregularly reticulate in *Hackeriapis* and all our other subgenera. Unfortunately *Chalicodoma* (*Hackeriapis*) *ustulata* is intermediate in this respect. The punctures of the scutum and mesepisterna are not in rows in *Hackeriapis* as they are in *Callomegachile*.

Usually small, slender bodied, parallel sided; posterior part of thorax as in *Chalicodoma*, *sensu stricto* (see discussion of Megachilini); postgradular grooves usually present on second and third terga, not fasciate except in *subsericauda*; terga often with apical pubescent fasciae; head little to much developed posteriorly, preoccipital carina present in some cases; pronotal lobe carinate.

FEMALE: Mandible shining reticulate (almost dull in *ustulata*), two- to five-toothed, very variable in shape, without cutting edge; first flagellar segment shorter than second. Middle and hind basitarsi shorter and narrower than corresponding tibiae; claws simple or with basal tooth, which may be large. Metasoma parallel sided (quite robust in a few species such as *modesta* and *simpliciformis*), sixth tergum distinctly concave apically in profile because of projecting apex, lateral margins straight or slightly concave apically, surface with short suberect hairs or these replaced by appressed tomentum; sixth sternum with scopa over almost entire surface but posterior margin usually bare and shining; sterna without apical bands of hair (except in *atrella*).

MALE: Mandible tridentate, without basal inferior projection, in some cases with median

one; first flagellar segment shorter, usually much shorter, than second. First coxa hairy or smooth and bare anteriorly, with or without apical spine, without rufescent spicules; anterior tarsus slender and unmodified to much expanded; middle tibial spur present, claws symmetrical; middle and hind basitarsi shorter and slenderer than corresponding tibiae, usually much so. Carina of sixth tergum little produced, not dentate except in *subsericauda*, bilobed or even rounded (*alleynae*); margin of sixth tergum with four small teeth, median ones often reduced to weak convexities; usually three exposed sterna or only margin of fourth exposed, fourth with margin thin and surface less punctate and hairy than other sterna; fifth sternum with or without medasternal area with specialized capitate hairs; sixth with such hairs; gonocoxites not lobed apically.

As indicated above, there is much variability among the species of this subgenus. The species in group *a* below, while exhibiting much morphological diversity (about as much as in *Chelostomoides* in America; see Mitchell, 1937), are a reasonably compact group of relatively uniform aspect. All have strong transverse grooves on the second and third terga. The often grotesque modifications of the mandibles of the female result in mandibular variation from two (*remeata*) to five teeth. The claws are usually simple, although some have a tooth, which is occasionally large as in *alani*; in *Chalicodoma longiceps* the basal tooth takes the form of a large long lobe. The front tarsi of the male may be enlarged, as in *nigrovittata*, without other commonly associated modifications, or in other species (e.g., *ferox*), the front tarsi are enlarged, the front coxae smooth anteriorly and spined apically, and the mandibles have a median inferior prominence. The coxae are also spined (but not smooth) in males of some forms that have unmodified tarsi. There are only three exposed sterna in males of this group, except that the thin, not much punctured, and not very hairy (in contrast to preceding sterna) margin of the fourth is often exposed.

In group *a* also, as in *Chelostomoides* and *Chelostomoda*, the scutellum is not much bent down posteriorly, the metanotum is sloping, not nearly vertical, and the basal part of the propodeum is relatively horizontal. In some

of the more robust species (e.g., *simpliciformis*) the posterior part of the thorax is somewhat more vertical.

A most remarkable species, included below in group *a* only because in its small size and general appearance it resembles small species of that group, and because it is not at all similar to members of group *b*, is *Chalicodoma subsericauda*. If the female were known, the species would probably be placed in a separate subgenus. It differs from other *Hackeriapis* in the several long teeth on the carina of the sixth tergum of the male. The fourth sternum is rather broadly exposed and seems to have punctation and pubescence as on the preceding sterna. The mandibles are largely pale yellow. The deep grooves across the bases of the metasomal terga are occupied by distinct bands of pale hairs as in the American subgenus *Chelostomoides*.

Chalicodoma atrella is placed in this subgenus (group *a*), but it is peculiar in having apical fringes on the second to fourth sterna laterally. In this respect it approaches *Chelostomoda*.

Group *b* has been segregated in the list below, not because its species have any common features, but because they differ from the usual sort of *Hackeriapis* to a greater or lesser degree. Some of them might be placed in separate subgenera were there not intermediates or confusing combinations of characters among the various species. Certain

aspects of the variation among these usually large species are indicated in table 4. For the most part, the characters are those already discussed for group *a*. The grooves of terga 2 and 3 (column 1) grade from deep to very shallow, so that in some cases the symbol was rather arbitrary. The number of exposed sterna (column 2) is possibly incorrect for *ustulata* and *mackayensis*; I have only one male of each, and their abdomens may have been artificially straightened, exposing the fourth sternum rather fully. In the other species the fourth sternum, even if exposed, is thin, the posterior margin membranous, and the punctation and vestiture considerably less than for the third. Thus all the species except perhaps *semiluctuosa* belong basically to the group with but three exposed sterna. In group *b* the spine on the front coxa of the male (column 3) is associated with expanded tarsi and with a sparsely hairy or even smooth anterior surface of the coxa, although the tarsus is little expanded in *ustulata*. The mandibular projection of the male (column 5) is an inferior median one. Column 7 relates to the steepness of the posterior truncation of the mesosoma; in most *Hackeriapis*, as mentioned above, it is not very steep, the posterior end of the scutellum not being vertical, the metanotum being sloping, and the base of the propodeum being nearly horizontal. There are various degrees of steepness of this truncation, even in group *a*, as mentioned

TABLE 4
SOME CHARACTERS OF CERTAIN SPECIES OF *Hackeriapis*

Species	1 Tergal Grooves	2 Exposed Sterna, Male	3 Spine Coxa 1, Male	4 Tooth on Claw	5 Mandibu- lar Pro- jection, Male	6 Mandible of Female Porrect	7 Pro- podeum Steep	8 Pre- tegular Lamella
Group a	+	3	±	±	±	±	—	—
Group b								
<i>mackayensis</i>	+	4?	—	Small	—	—	—	—
<i>suffusipennis</i>	+	3	—	+	—	—	—	+
<i>nasutus</i>	+			+		+	—	—
<i>aurifrons</i>	—	3	+	+	+	±	—	—
<i>lucidiiventris</i>	+	3	+	+	+	—	—	—
<i>semiluctuosa</i>	—	4	+	—	—	+	—	—
<i>fumipennis</i>	—	3	—	+	—	—	+	+
<i>macleayi</i>	—			+		—	+	+
<i>ustulata</i>	—	4?	+	+	+	—	+	—

above, but in a few species, as shown in table 4, it is quite vertical as in the larger "non-heriadiform" *Chalicodoma* species. Column 8 represents a character not hitherto discussed. In most *Chalicodoma* there is a vertical carina on the pronotal lobe. In certain species, as indicated, the upper part of this carina is expanded to form a transverse lamella in front of the tegula. This structure helps to distinguish some of the large species here included in *Hackeriapis* from the occasionally similar species of *Callomegachile*. In *C. lucidiventris* the lower part of the carina is produced, but the upper part remains low.

Most of the species of group *b*, but especially the last five in table 4, are large, and some of their peculiarities may be related to this fact. The heads of the largest species are especially large and much developed posteriorly. *Chalicodoma* (*H.*) *fumipennis* and *macleayi* are coarsely punctate. Some peculiarities that may be worth noting by persons tempted to break up this group are the following: In *mackayensis* there is a row of pits across the base of the propodeum (the same is true of *nigrovittata* in group *a*); in *macleayi* there is a smooth transverse channel in this location. In the latter species the front and middle tibiae are coarsely roughened and tuberculate on their outer surfaces.

In the above discussion and in table 4 certain little groups of species (in some cases synonyms) are indicated by a single name. Thus *nuda* and *latipes* go with *lucidiventris*; *argenteifer* with *nasuta*; *blackburni* with *semiluctuosa*; *rugosa*, *punctata*, and *sericeicauda* with *fumipennis*; and *dinognatha* and *revicta* with *macleayi*.

Chalicodoma ustulata is worthy of special note because of its coloration which is like that of *C. (Callomegachile) mystaceana* and *Megachile (Callochile) mystacea*. The three superficially similar species can be collected together in Queensland. *Chalicodoma ustulata* is structurally unusual in several features other than those listed in table 4, e.g., the almost dull mandibular surfaces and the very prominent teeth of the margin of the sixth tergum of the male.

DISTRIBUTION: Tasmania, Australia north to northern Queensland and northern Western Australia, New Guinea. *Chalicodoma mackayensis* occurs on Lord Howe Island

where it may well have been introduced from eastern Australia; it also occurs in Queensland and New South Wales.

INCLUDED SPECIES

- Chalicodoma (Hackeriapis)* (a) *alani* (Cockerell, 1929d) (*Megachile*) n. comb. (Q.M.)
 (a) *alleynae* (Rayment, 1935) (*Megachile*) n. comb. (C.S.I.R.O.)
 (a) *apicata* (Smith, 1853) (*Megachile*) n. comb. (B.M.)
 (a) *apposita* (Rayment, 1939) (*Megachile*) n. comb. (C.S.I.R.O.)
 (b) *argenteifer* (Cockerell, 1910i) (*Megachile*) n. comb. (Berlin*)
 (a) *atrella* (Cockerell, 1906b) (*Megachile*) n. comb. (B.M.)
 (b) *aurifrons* (Smith, 1853) (*Megachile*) n. comb. (B.M.)
 (a) *axillaris* (Meade-Waldo, 1915) (*Megachile*) n. comb. (B.M.)
 (a) *barvonensis* (Cockerell, 1914i) (*Megachile*) n. comb. (U.S.N.M.)
 (a) *beutenmulleri* (Cockerell, 1907a) (*Megachile*) n. comb. (A.M.N.H.)
 (b) *blackburnii* (Froggatt, 1893) (*Megachile*) n. comb. (S.A.M.)
 (a) *calida* (Smith, 1879) (*Megachile*) n. comb. (B.M.)
 (a) *callura* (Cockerell, 1914i) (*Thaumatoma*) n. comb. (B.M.)
 (a) *canifrons* (Smith, 1853) (*Megachile*) n. comb. (B.M.)
 (a) *cliffordi* (Rayment, 1953a) (*Megachile*) n. comb. (C.S.I.R.O.)
 (a) *clypeata* (Smith, 1853) (*Megachile*) n. comb. (Ox.)
 (a) *derelecta* (Cockerell, 1913j) (*Megachile*) n. comb. (Q.M.)
 (b) *dinognatha* (Cockerell, 1929d) (*Megachile*) n. comb. (Q.M.)
 (a) *eucalypti* (Cockerell, 1910e) (*Megachile*) n. comb. (B.M.)
 (a) *erythropyga* (Smith, 1853) (*Megachile*) n. comb. (B.M.)
 (a) *ferox* (Smith, 1879) (*Megachile*) n. comb. (B.M.)
 (a) *franki* (Fries, 1920) (*Thaumatoma*) n. comb. (desc.)
 (a) *fultoni* (Cockerell, 1913f) (*Megachile*) n. comb. (U.S.N.M.)
 (a) *fulvomarginata* (Cockerell, 1906b) (*Megachile*) n. comb. (B.M.)
 (b) *fumipennis* (Smith, 1868a) (*Megachile*) n. comb. (B.M.)
 (a) *gilbertiella* (Cockerell, 1910e) (*Megachile*) n. comb. (B.M.)
 (a) *grandis* (Rayment, 1934) (*Megachile*) n.

- comb. (W.A.M.) Preoccupied by *Megachile grandis* Lepeletier, 1841, and Cresson, 1872; not renamed because probably a synonym of *clypeata*
- (a) *hackeri* (Cockerell, 1913j) (*Megachile*) n. comb. (Q.M.)
- (a) *hardyi* (Cockerell, 1929d) (*Megachile*) n. comb. (Q.M.)
- (a) *heliophila* (Cockerell, 1913g) (*Megachile*) n. comb. (U.S.N.M.)
- (a) *henrici* (Cockerell, 1907a) (*Megachile*) n. comb. (A.M.N.H.)
- (a) *heriadiiformis* (Smith, 1853) (*Megachile*) n. comb. (B.M.)
- (a) *holura* (Cockerell, 1912b) (*Megachile*) n. comb. (C.S.I.R.O.)
- (a) *horatii* (Cockerell, 1913j) (*Megachile*) n. comb. (U.S.N.M.)
- (a) *ignita* (Smith, 1853) (*Megachile*) n. comb. (B.M.)
- (a) *latericauda* (Cockerell, 1921) (*Megachile*) n. comb. (B.M.)
- (b) *latipes* (Smith, 1853) (*Megachile*) n. comb. (B.M.)
- (a) *leeuwinensis* (Meade-Waldo, 1915) (*Megachile*) n. comb. (B.M.)
- (a) *leucopyga* (Smith, 1853) (*Megachile*) n. comb. (B.M.)
- (a) *longiceps* (Meade-Waldo, 1915) (*Megachile*) n. comb. (B.M.)
- (b) *lucidiventris* (Smith, 1853) (*Megachile*) n. comb. (B.M.)
- (b) *mackayensis* (Cockerell, 1910h) (*Megachile*) n. comb. (B.M.)
- (b) *macleayi* (Cockerell, 1907a) (*Megachile*) n. comb. (A.M.N.H.)
- (a) *micrerythra* (Cockerell, 1910h) (*Megachile*) n. comb. (B.M.)
- (a) *modesta* (Smith, 1862a) (*Megachile*) n. comb. (B.M.)
- (a) *monkmani* (Rayment, 1935) (*Megachile*) n. comb. (C.S.I.R.O.)
- (a) *mundifica* (Cockerell, 1921) (*Megachile*) n. comb. (Q.M.)
- (b) *nasuta* (Smith, 1868a) (*Metachile*) n. comb. (B.M.)
- (a) *nigrovittata* (Cockerell, 1906b) (*Megachile*) n. comb. (B.M.)
- (b) *nuda* (Rayment, 1935) (*Megachile*) n. comb. (C.S.I.R.O.) Preoccupied by *M. nuda* Mitchell, 1930; not renamed because probably not a valid species
- (a) *oblonga* (Smith, 1879) (*Megachile*) n. comb. (B.M.)
- (a) *oculiformis* (Rayment, 1956b) (*Megachile*) n. comb. (desc.)
- (a) *oculipes* (Cockerell, 1910e) (*Megachile*) n. comb. (B.M.)
- (a) *ordinaria* (Smith, 1853) (*Megachile*) n. comb. (B.M.)
- (q) *papuae* Michener, new species (A.M.N.H.) New Guinea
- (a) *paracallida* (Rayment, 1935) (*Megachile*) n. comb. (C.S.I.R.O.)
- (a) *pararhodura* (Cockerell, 1910h) (*Megachile*) n. comb. (B.M.)
- (a) *paratasmanica* (Rayment, 1955b) (*Megachile*) n. comb. (C.S.I.R.O.)
- (a) *phillipensis* (Rayment, 1935) (*Megachile*) n. comb. (C.S.I.R.O.)
- (a) *preissi* (Cockerell, 1910i) (*Megachile*) n. comb. (Berlin*)
- (b) *punctata* (Smith, 1853) (*Megachile*) n. comb. (B.M.)
- (a) *ramulipes* (Cockerell, 1913f) (*Megachile*) n. comb. (B.M.)
- (a) *relicta* (Cockerell, 1913f) (*Megachile*) n. comb. (B.M.)
- (a) *remeata* (Cockerell, 1913f) (*Megachile*) n. comb. (B.M.)
- (b) *revicta* (Cockerell, 1913f) (*Megachile*) n. comb. (U.S.N.M.)
- (a) *rhodura* (Cockerell, 1906b) (*Megachile*) n. comb. (Q.M.)
- (a) *rufolobata* (Cockerell, 1913f) (*Megachile*) n. comb. (B.M.)
- (a) *rufapicata* (Cockerell, 1929c) (*Megachile*) n. comb. (A.M.)
- (b) *rugosa* (Smith, 1879) (*Megachile*) n. comb. (B.M.)
- (a) *semicandens* (Cockerell, 1910i) (*Megachile*) n. comb. (desc. Berlin*)
- (b) *semiluctuosa* (Smith, 1853) (*Megachile*) n. comb. (B.M.)
- (b) *sericeicauda* (Cockerell, 1910e) (*Megachile*) n. comb. (B.M.)
- (a) *silvestris* (Erickson and Rayment, 1951) (*Megachile*) n. comb.
- (a) *simpliciformis* (Cockerell, 1918b) (*Megachile*) n. comb. (Q.M.)
- (a) *speluncarum* (Meade-Waldo, 1915) (*Megachile*) n. comb. (B.M.)
- (a) *stalker* (Cockerell, 1910h) (*Megachile*) n. comb. (B.M.)
- (a) *subabdominalis* (Rayment, 1935) (*Megachile*) n. comb. (C.S.I.R.O.)
- (a) *subremotula* (Rayment, 1934) (*Megachile*) n. comb. (W.A.M.)
- (a) *subsericcauda* (Rayment, 1935) (*Megachile*) n. comb. (C.S.I.R.O.)
- (b) *suffusipennis* (Cockerell, 1906b) (*Megachile*) n. comb. (B.M.)
- (a) *tasmanica* (Cockerell, 1916a) (*Megachile*) n. comb. (B.M.)
- (a) *tomentella* (Cockerell, 1906b) (*Megachile*) n. comb. (B.M.)

- (a) *tosticauda* (Cockerell, 1912b) (*Megachile*) n. comb. (B.M.)
- (a) *trichognatha* (Cockerell, 1910i) (*Megachile*) n. comb. (Berlin*)
- (a) *trichomarginata* (Rayment, 1930a) (*Megachile*) n. comb. (C.S.I.R.O.*)
- (a) *turneri* (Meade-Waldo, 1913) (*Thaumatosoma*) n. comb. (B.M.)
- (b) *ustulata* (Smith, 1862a) (*Megachile*) n. comb. (B.M.)
- (a) *victoriae* (Cockerell, 1913j) (*Megachile*) n. comb. (B.M.)
- (a) *wilsoni* (Cockerell, 1929d) (*Megachile*) n. comb. (Q.M.)

SCHIZOMEGACHILE, NEW SUBGENUS

Text figures 657-660, 697-700, 714

TYPE: *Megachile monstrosa* Smith, 1868.

This subgenus is probably a derivative of *Hackeriapis* but is so different that it is unsatisfactory to leave it in that group. The single included species is larger than any *Hackeriapis*, with the mandibles of the female porrect and the clypeus not overhanging the labrum. These characters suggest *Eumegachilana* and some species of *Callomegachile*, but *Schizomegachile* has the dull coloration of *Hackeriapis* and various distinctive features as described below. The mandibular and clypeal structures of the female mentioned above are also similar to those of *Chalicodoma* (*Hackeriapis*) *semiluctuosa*. Like *Hackeriapis*, *Schizomegachile* belongs to a group of subgenera in which there are basically only three exposed metasomal sterna in the male. However, in *Schizomegachile* the fourth sternum is broadly exposed but smoother and much less hairy than the preceding sterna. Perhaps it is secondarily exposed. In the following description the major features that distinguish *Schizomegachile* are italicized.

Large, body parallel sided; posterior part of thorax as in *Chalicodoma*, *sensu stricto* (see discussion of *Megachilini*); postgradular grooves of metasomal terga weak; terga without apical pubescent fasciae except for first and sides of second; head much developed posteriorly, preoccipital carina present laterally; pronotal lobe with carina lamelliform; scutal and mesepisternal punctures arranged in irregular rows as in *Callomegachile*.

FEMALE: Mandible shining reticulate, three-toothed, more than twice as long as broad,

without cutting edge; clypeus not overhanging labrum, base greatly elevated and ornate; first flagellar segment shorter than second; lower genal areas each with large mesial projection meeting over posterior part of proboscideal fossa. Middle and hind basitarsi shorter and narrower than corresponding tibiae; claws each with two teeth on ventral surface, second larger. Metasoma parallel sided, sixth tergum distinctly concave apically in profile because of projecting apex, lateral margins nearly straight seen from above, surface without appressed tomentum, subapically with median, longitudinal, shining, flat-topped ridge which is possibly remnant of a pygidial plate; sixth sternum with hairs much shorter than those of scope, without hairless margin, but apically with narrow median shining ridge ending at acutely pointed apex of sternum; sterna without apical hair bands.

MALE: Mandible bidentate, with basal inferior projection in form of a translucent lamella; first flagellar segment much shorter than second. First coxa hairy, with large apical spine, without rufescent spicules; anterior tarsus much expanded; middle tibial spur present, claws symmetrical; middle basitarsus less than half as long as tibia, slightly narrower than tibia; hind tibia with spurs absent, possibly represented by large, immovable, acutely pointed projection, basitarsus somewhat shorter than and less than half as wide as tibia. Carina of sixth tergum little produced, not dentate, bilobed; margin of sixth tergum without teeth; four exposed sterna, the fourth less coarsely punctate and less hairy than preceding ones; fifth and sixth with no clear separation into presternites, medasternites, and poststernites, fifth well sclerotized, modified hairs only in small posterior median region, sixth entirely membranous medially, but represented by a large sclerite on each side which bears two areas of large modified hairs; gonocoxites slender and unmodified apically.

DISTRIBUTION: Western Australia, New South Wales, Queensland.

INCLUDED SPECIES

- Chalicodoma* (*Schizomegachile*) *cornifera* (Radoszkowski, 1874) (*Megachile*) n. comb.
- monstrosa* (Smith, 1868a) (*Megachile*) n. comb. (B.M.)

SUBGENUS *THAUMATOSOMA* SMITH

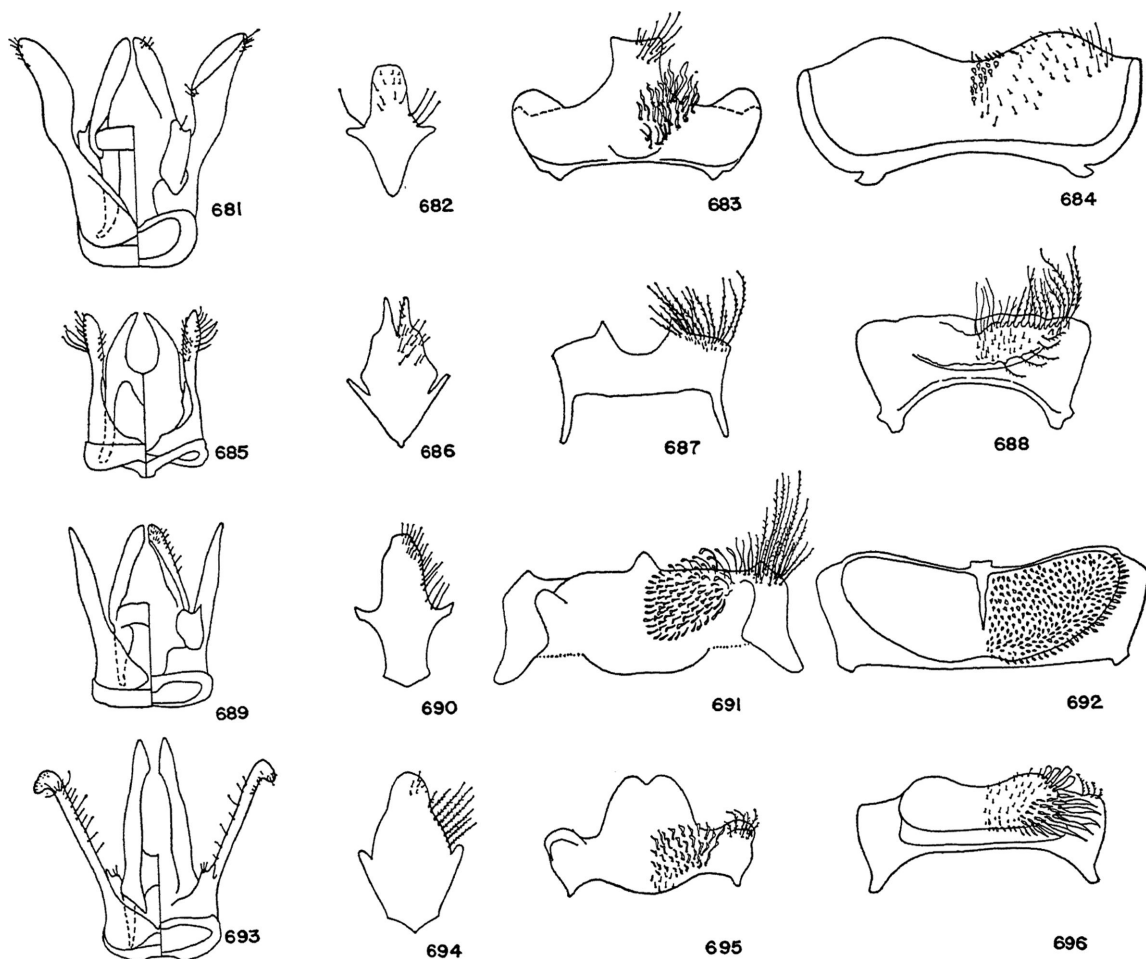
Text figures 681–684, 705–706, 717–718

Thaumatosoma SMITH, 1865, p. 394. Type: *Thaumatosoma duboulaii* Smith, 1865 (monobasic).

This strange subgenus consists of a rather small heriadiform species related to *Hackeriapis* as shown by the form of the posterior part of the thorax and the tergal grooves, but differing in having, in the male, much-attenuated antennae, with the last two segments broadly expanded, only one hind tibial spur, and four fully exposed sterna. Unfortunately the female is unknown to me. Certain species

of *Hackeriapis*, especially *turneri*, have somewhat similar antennae in the males but none of the other special features of *Thaumatosoma*. The African and Indian species that have been assigned to *Thaumatosoma* are in reality osmiine bees, perhaps to be included in *Hoplitis* or *Anthocopa* or allied undescribed genera.

MALE: Small, slender bodied, parallel sided; posterior part of thorax as in *Hackeriapis* (see discussion of Megachilinae); postgradular grooves deep on second and third terga; posterior margin of first tergum procurved, the tergum short dorsally; preoccipital carina and carina on pronotal lobe absent.



FIGS. 681–696. Male genitalia and eighth, sixth, and fifth sterna of Megachilinae. 681–684. *Chalicodoma* (*Thaumatosoma*) *duboulaii*. 685–688. *C. (Rhodomegachile) abdominalis*. 689–692. *C. (Austrochile) resinifera*. 693–696. *C. (Chelostomoda) spissula parvula*.

Mandible tridentate without basal inferior projection; antennal scape short, thick, *flagellar segments 1 to 9 exceedingly long and slender, the first longest, tenth and eleventh flagellar segments short and flat, broadly expanded*, antenna reaching to second or third metasomal tergum. First coxa hairy, without apical spine, without rufescent spicules; anterior tarsus slender, little modified; middle tibial spur present, claws symmetrical; *hind tibia with only one spur*; middle and hind basitarsi shorter and slenderer than corresponding tibiae; hind mediotarsal segments broadened. Carina of sixth tergum little produced, not dentate, bilobed; margin of sixth tergum with four teeth, lateral ones small, submedian ones long; *four exposed sterna*, fourth similar to third in sculpture and vestiture; first sternite medially strongly protuberant, apically with an elevated lobe at each side; fifth with medasternal area with but few specialized capitate hairs, presternite directed upward at right angles to rest of sternum (hence appearing

narrow in fig. 684); sixth with such hairs, posterior lateral areas strongly sclerotized, bullate; gonocoxites not lobed apically.

DISTRIBUTION: Western Australia, Northern Territory, South Australia.

INCLUDED SPECIES

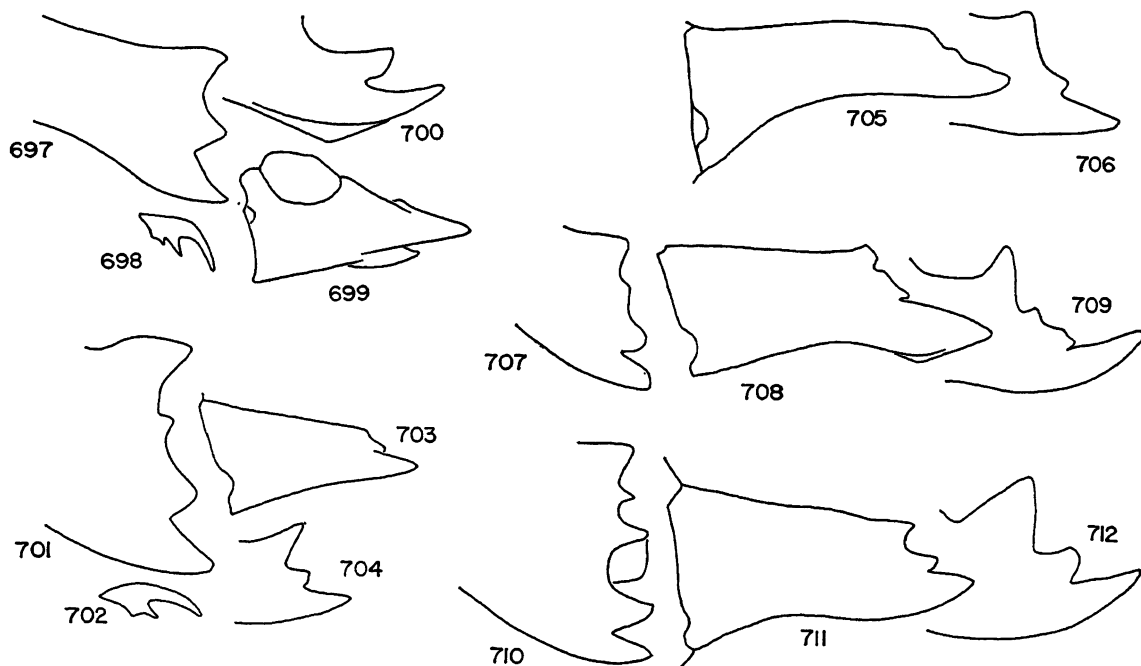
Chalicodoma (*Thaumatoma*) *duboulaii* (Smith, 1865) (*Thaumatoma*) n. comb. (B.M.)

RHODOMEGACHILE, NEW SUBGENUS

Text figures 685–688, 701–704, 716

TYPE: *Megachile abdominalis* Smith, 1853.

This small subgenus consists of forms with the metasoma red (very rarely wholly red in *Hackeriapis*), the tergal fasciae absent or reduced to small lateral patches, and the tergal grooves (found in all similarly small *Hackeriapis*) absent. The broad glossa is characteristic but is approached by some *Hackeriapis* (e.g., *ferox*). The steep posterior thoracic truncation and straight profile of the sixth tergum also differentiate this subgenus from



FIGS. 697–712. Megachilinae. 697–700. Apex of mandible and claw of female, outer side of mandible of male, and apex of mandible of male of *Chalicodoma* (*Schizomegachile*) *monstrosa*. 701–704. Same of *C. (Rhodomegachile) abdominalis*. 705, 706. Outer side and apex of mandible of male of *C. (Thaumatoma) duboulaii*. 707–709. Apex of mandible of female, outer side of mandible of male, and apex of mandible of male of *C. (Austrochile) resinifera*. 710. Apex of mandible of female of *C. (Chelostomoda) carteri*. 711, 712. Outer side and apex of mandible of male of *C. (C.) spissula parvula*.

Hackeriapis. The pretegular lamella is found in some *Hackeriapis*, but only in large species.

Small, robust, but parallel-sided species; posterior part of thorax similar to that of *Chalicodoma*, *sensu stricto*, differing from that of most *Hackeriapis* in being more vertical, the rear edge of the scutellum nearly vertical, the metanotum vertical, and the propodeum vertical except for a rather narrow sloping, pitted basal zone. Head considerably developed posteriorly for such small forms, preoccipital carina present; *glossa broadened, ligulate*. Prothoracic lobe with carina expanded into transverse lamella in front of tegula. *Metasoma red*, without deep postgradular grooves.

FEMALE: Mandibles rather slender, four-toothed, without cutting edge; first flagellar segment shorter than second. Basitarsi shorter and more slender than corresponding tibiae; claws with basal tooth. Metasoma parallel sided; sixth tergum almost straight in profile, sides straight or slightly convex seen from above; surface without erect hairs, with tomentum; sixth sternum with scopal hairs over surface except for narrow, bare, apical margin; sterna without apical fasciae.

MALE: Mandible tridentate, without inferior projection; first flagellar segment broader than long and much shorter than second. First coxa hairy on anterior surface, without spine or rufescent bristles; anterior tarsus

very slender, in some cases much elongated; middle tibial spur present, claws symmetrical; middle and hind basitarsi narrower than tibiae and much shorter, hind one not more than half tibial length. Carina of sixth tergum absent or reduced to short, transverse, median, non-emarginate ridge; posterior margin of sixth tergum with four teeth; three exposed sterna.

DISTRIBUTION: Southern to northern Queensland.

INCLUDED SPECIES

Chalicodoma (*Rhodomegachile*) *abdominalis* (Smith, 1853) (*Megachile*) n. comb. (B.M.)
deanii (Rayment, 1935) (*Megachile*) n. comb. (C.S.I.R.O.)

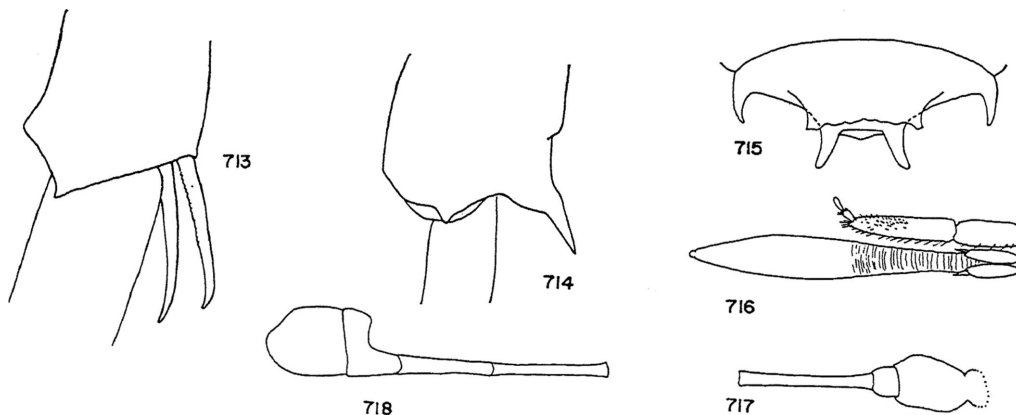
AUSTROCHILE, NEW SUBGENUS

Text figures 689–692, 707–709, 715

TYPE: *Megachile resinifera* Meade-Waldo, 1915.

This subgenus consists of moderate-sized bees, more robust than most *Hackeriapis*, but, as in that subgenus, with pale or mixed pubescence producing a gray appearance, and usually with pale apical fasciae on at least some of the metasomal terga. The most noteworthy characters by which this subgenus differs from *Hackeriapis* are italicized in the following description:

Moderate sized, rather robust, parallel



FIGS. 713–718. Megachilinae. 713, 714. Apex of hind tibia and tibial spurs (or equivalent spine) of male of *Chalicodoma* (*Hackeriapis*) *semiluctuosa* and *C.* (*Schizomegachile*) *monstrosa*. 715. Apex of metasoma of male (sixth tergum, seventh visible between median spines of sixth) of *C.* (*Austrochile*) *resinifera*. 716. Glossa and labial palpus of *C.* (*Rhodomegachile*) *abdominalis*. 717, 718. Base and apex of antenna of male of *C.* (*Thaumatosome*) *duboulaii*.

sided; posterior part of thorax as in some of the larger *Hackeriapis* such as *semiluctuosa*; postgradular grooves moderately deep on second and third terga, not fasciate; terga often with apical, pale, pubescent fasciae; head little developed posteriorly, preoccipital carina weak and broken dorsally; pronotal lobe with high carina or lamella; *first metasomal sternum with large median subapical process or spine*.

FEMALE: Mandible shining reticulate, four-toothed, without cutting edge; first flagellar segment slightly longer than broad and slightly longer than second. Middle and hind basitarsi shorter and narrower than corresponding tibiae; claws with large, blunt, sub-basal tooth or angle. Metasoma parallel sided, quite robust; sixth tergum distinctly concave apically in profile because of projecting apex, lateral margins nearly straight, surface with appressed hair, without erect hair; sixth sternum with scopa over much of exposed surface, but posterior margin with short hairs not similar to those of scopa; sterna without apical bands of hair.

MALE: Mandible three-toothed, middle tooth small and in some cases emarginate so that mandible is four-toothed, with the two median teeth small; basal inferior projection of mandible absent; first flagellar segment shorter than second. First coxa densely hairy on anterior surface, with apical spine, without rufescent spicules; anterior tarsus not, to moderately, broadened; middle tibial spur present, claws symmetrical; middle and hind basitarsi much shorter and slenderer than corresponding tibiae, hind basitarsus less than half as long as tibia. *Carina of sixth tergum absent laterally but in middle third or more, abruptly and strongly produced, usually not emarginate, weakly crenulate to coarsely serrate*; margin of sixth tergum with four long teeth (distinct but rounded teeth in *rufomaculata*), median ones closer together than distance from one of them to outer tooth; four exposed sterna but fourth thin and less punctate than third, so that number of exposed sterna is basically three; fifth and sixth sterna with medasternal areas densely covered with capitate hairs; gonocoxites broad, laterally compressed, with simple, non-lobate outline.

DISTRIBUTION: Australia north to southern Queensland.

INCLUDED SPECIES

- Chalicodoma* (*Austrochile*) *kirbiella* (Rayment, 1953a) (*Megachile*) n. comb. (C.S.I.R.O.)
kirbyana (Cockerell, 1906b) (*Megachile*) n. comb. (B.M.)
portlandiana (Rayment, 1953a) (*Megachile*) n. comb. (C.S.I.R.O.)
recisa (Cockerell, 1913f) (*Megachile*) n. comb. (Q.M.)
remotula (Cockerell, 1910i) (*Megachile*) n. comb. (Berlin*)
resinifera (Meade-Waldo, 1915) (*Megachile*) n. comb. (B.M.)
rotnestensis (Rayment, 1934) (*Megachile*) n. comb. (W.A.M.)
rufomaculata (Rayment, 1935) (*Megachile*) n. comb. (C.S.I.R.O.)
sexmaculata (Smith, 1868) (*Megachile*) n. comb. (B.M.)
subferox (Meade-Waldo, 1915) (*Megachile*) n. comb. (B.M.)

SUBGENUS CHELOSTOMODA MICHENER

Text figures 693–696, 710–712

Chelostomoda MICHENER, 1962a, p. 24. Type: *Megachile spissula parvula* Strand, 1913 (original designation).

This subgenus has exactly the appearance of small, rather ordinary species of *Hackeriapis* or *Chelostomoides*, and *M. spissula* from Taiwan was placed in *Chelostomoides* by Mitchell (1937). This error is entirely understandable in view of the similarity to *Chelostomoides*. The subgenus differs especially by the characters italicized in the description below, which also separate it from *Hackeriapis*. The presence of a cutting edge in the second interspace of the mandible of the female is unique in *Chalicodoma*; the only *Megachile* having only this cutting edge are in the subgenera *Sayapis*, *Mitchellapis*, and *Eumegachile*.

Small, slender bodied, parallel sided, coarsely sculptured; posterior part of thorax as well as transverse tergal grooves as in *Hackeriapis* and *Chelostomoides*, *tergal grooves not fasciate*; terga with apical pubescent fasciae; head not much developed posteriorly, lateral ocellus being little nearer eye than margin of vertex; preoccipital ridge sharp but not carinate; pronotal lobe carinate.

FEMALE: Mandible five-toothed, *large incomplete cutting edge in second interspace*; first flagellar segment broader than long, slightly

shorter than second. Middle and hind basitarsi distinctly shorter and narrower than corresponding tibiae; claws simple. Metasoma parallel sided, sixth tergum distinctly concave in profile apically, lateral margins about straight seen from above, surface with neither erect hair nor pale tomentum; sixth sternum with scopa over entire surface, *no shining marginal area; sterna 2 to 4 with apical hair bands* at least laterally, as in *Eutricharaea*, a subgenus of *Megachile*.

MALE: Mandible tridentate, no inferior projection; first flagellar segment slightly broader than long, less than half as long as second. First coxa hairy on anterior surface, without apical spine or reddish bristles; anterior tarsi somewhat broadened; middle tibial spur present, claws symmetrical; middle and hind basitarsi much less than half of length of corresponding tibiae and narrower. Carina of sixth tergum rounded, not toothed, region of carina bulbous except medially, middle of carina minutely and weakly emarginate; margin of sixth tergum with a tooth at each side but no submedian teeth; three exposed sterna; fifth and sixth sterna both with capitate hairs; gonocoxites slender but bent outward and somewhat enlarged at apices.

DISTRIBUTION: India to Philippine Islands, Taiwan, Japan, Indonesia, Ambon, Kai, New Guinea, Solomon Islands, and northern Queensland.

INCLUDED SPECIES

- Chalicodoma* (*Chelostomoda*) *bougainvillei* (Cockerell, 1911b) (*Megachile*) n. comb. (C.S.I.R.O.) Solomon Islands
carteri (Cockerell, 1929c) (*Megachile*) (A.M.)
erimae (Mocsáry, 1899) (*Megachile*) New Guinea, Ambon
funneli (Cockerell, 1907a) (*Megachile*) n. comb. (A.M.N.H.) Ambon
inflaticauda (Cockerell, 1939) (*Megachile*) n. comb. (Bishop)

Outside our area, the following are placed in this subgenus: *spissula* (Cockerell), *parvula* (Strand) (Taiwan); *nana* (Bingham), *phaola* (Cameron) (India); *nematocera* (Cockerell) (Thailand); *moera* (Cameron) (Borneo); *ocellifera* (Cockerell), *tarsatula* (Cockerell) (Philippine Islands); *sasakiella* (Cockerell) (Japan). The type species was designated as

parvula, because that is a form of which I have seen both sexes. The description of the male is based on that form, since no males are known to me from our area. However, all the species listed above are very similar.

It may be worthy of note that *parvula* Strand, 1913, is a homonym of *Megachile parvula* Lepeletier, 1841, but is presumably only a variant of *spissula* Cockerell and hence not worth renaming.

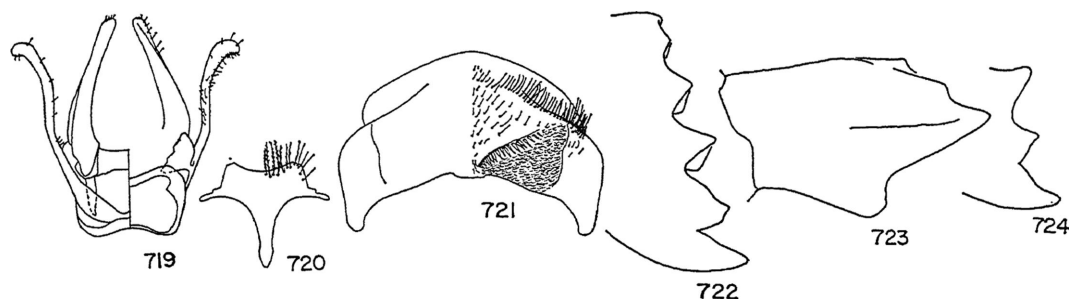
GENUS CREIGHTONELLA COCKERELL

Text figures 719-724

Creightonella COCKERELL, 1908b, p. 146. Type: *Megachile mitimia* Cockerell (original designation).

This group name has previously been used (except by Michener, 1962a), as an African subgenus of *Megachile*, for a group of species with the carina of the sixth tergum of the male very coarsely toothed. Our species has this carina much more rounded, but in some specimens of the African species *consanguinea* it is almost equally rounded. Most of the African species have striking lateral patches of white pubescence on an otherwise black metasoma, but some have the metasoma red, as in most *Gronoceras*, an African group of *Chalicodoma*. Both of these types of metasomal coloration occur among Asiatic species of *Creightonella* (*albifrons* black and white, the others red). The common insular species (*frontalis*) that reaches our area is entirely black, but the form or species *assimilis* has the posterior part of the metasoma largely brown.

Like the subgenera of *Megachile*, *Mitchellapis* and *Sayapis*, this genus combines characters not usually associated: a parallel-sided body, cutting edges on the mandibles of the female, and the posterior thoracic structure approximately like that of *Megachile*, *sensu stricto*. It differs from those subgenera in having three cutting edges on the six-toothed mandible of the female and in the median ventral swelling of the mandible of the male, and is unique among close relatives of *Megachile* in having six exposed metasomal sterna in the male instead of three or four, and in having the eighth metasomal sternum (ignoring the spiculum) in the form of a transverse plate.



FIGS. 719-724. Megachilinae, *Creightonella frontalis*. 719-721. Male genitalia and eighth and sixth sternum of male. 722. Apex of mandible of female. 723, 724. Outer view and apex of mandible of male.

In the type species and certain other African forms the fourth sternum of the male is quadrispinose, and the fifth, although exposed, is smooth, not sculptured like the preceding ones. In the Indo-Malayan species, as in some African ones such as *consanguinea* (Smith), the six exposed sterna are little modified, and the first five are similarly punctate and hairy.

Very large, parallel-sided species; posterior part of thorax similar to that of *Megachile*, *sensu stricto*, but axillar fossa somewhat larger than usual in that group.

FEMALE: Mandible six-toothed, with rather small, incomplete cutting edges in second, third, and fourth intervals, edge in fourth interval small and inconspicuous from the front; first flagellar segment shorter than second. Middle and hind basitarsi much shorter and narrower than corresponding tibiae; claws simple. Metasoma parallel sided; sixth tergum scarcely concave in profile, without projecting apex, lateral margins nearly straight seen from above, surface with hairs longer than on preceding terga, no tomentum; sixth sternum with scopal hairs over almost entire surface, hiding posterior marginal bare zone; sterna without apical bands of pale hair.

MALE: Mandible tridentate, lower margin with median projection but lacking basal one; first flagellar segment much shorter than second. First coxa hairy anteriorly, with short, robust, blunt, inner apical spine, without rufescent spicules; anterior tarsi unmodified or very slightly broadened; middle tibial spur present, claws symmetrical; middle and hind basitarsi less than half as long as corresponding tibiae and much slenderer. Carina of

sixth tergum broadly expanded, slightly concave medially, slightly irregular, varying in extralimital species to coarsely toothed, disc of tergum with longitudinal median ridge; posterior margin of sixth tergum with strong lateral tooth; seventh tergum with margin strongly convex, disc with strong longitudinal, median ridge; six exposed sterna, the sixth with posterior margin broadly convex and forming closure of genital cavity, fifth and sixth sterna without membranous zones demarking medasternites such as are found in most *Megachile* and *Chalicodoma*; eighth sternum a transverse plate, hairy at apex, with very long spiculum; gonocoxite very slender, not lobed apically.

The habits of *frontalis* have been described by Michener and Szent-Ivany (1960). This species makes its own burrows in the soil and constructs cells of irregularly cut pieces of leaves. The biology of the closely related *C. atrata* has been studied by van der Meer Mohr (1929), but unfortunately it was identified as *Megachile tuberculata* (correct identification thanks to Dr. M. A. Lieftinck).

DISTRIBUTION: Africa, southern Asia from India to south China, Philippine Islands, Taiwan, Malaya, Indonesia, New Guinea, Bismarck Archipelago, Solomon Islands; one record (Friese, 1909; specimen not available) for northern Queensland.

INCLUDED SPECIES

Creightonella alecto (Smith, 1861) (*Megachile*) n. comb. (B.M.) New Guinea. Lectotype male here designated; associated females near *M. (Platycheile) foliata assimilis* (Friese, 1903b) (*Megachile*) n. comb. (H.N.M.) Kai

- frontalis* (Fabricius, 1804) (*Anthophora*) n. comb. Ambon
fuscipennis (Friese, 1903b) (*Megachile*) n. comb. (desc.) Kai
lachesis (Smith, 1861) (*Megachile*) n. comb. (Ox.) Batjan
megista (Cameron, 1901) (*Megachile*) n. comb. (B.M.) New Britain

The above names are probably all synonymous, the proper name being *C. frontalis* (see Lieftinck, 1958).

Outside our area, in the Indo-Malayan region, the following species are now known to belong to this genus: *albifrons* (Smith), *fraterna* (Smith), *bellula* (Bingham) male, not female (India); *fervida* (Smith) (China); *atrata* (Smith) (Philippine Islands); and *takaoensis* (Cockerell) (Taiwan).

GENUS MEGACHILE LATREILLE

Text figures 725-756

Megachile LATREILLE, 1802, p. 413, 433. Type: *Apis centuncularis* Linnaeus, 1758 (designation of Curtis, 1828, p. 218).

As the typical subgenus of *Megachile* does not occur in our area, further synonymy is omitted here except to point out that *Anthemois* Robertson is a synonym of *Megachile*, *sensu stricto*, in the sense in which the latter name is here understood.

In view of the discussion of generic characters under the subfamily Megachilinae, and the subgeneric descriptions given below, a generic description seems unnecessary here.

This generic name is here applied to all the broad-bodied leafcutting groups. In addition to the subgenera occurring in our area, the following belong to this genus: *Megachile* Latreille, 1802 (= *Anthemois* Robertson, 1903, *Cyphopyga* Robertson, 1903), *Litomegachile* Mitchell, 1934; *Neomegachile* Mitchell, 1934; *Cressoniella* Mitchell, 1934; *Delomegachile* Viereck, 1916; *Phaenosarus* Mitchell, 1934; *Megachiloides* Mitchell, 1924; *Derotropis* Mitchell, 1936; *Xeromegachile* Mitchell, 1934; *Argyropile* Mitchell, 1934; *Xanthosarus* Robertson, 1903; *Leptorachis* Mitchell, 1934; *Pseudocentron* Mitchell, 1934; *Acentron* Mitchell, 1934; *Melanosarus* Mitchell, 1934; *Chrysosarus* Mitchell, 1943; *Austromegachile* Mitchell, 1943; *Ptilosarus* Mitchell, 1943; *Dasymegachile* Mitchell, 1943; *Dactylomegachile* Mitchell, 1943; *Holcomegachile* Moure,

1953; *Tylomegachile* Moure, 1953; and *Amegachile* Friese, 1909.

The genus *Megachile* also includes certain parallel-sided forms which fall in the subgenera *Sayapis* Titus, 1905 (= *Gnathocera* Provancher, 1882; *Cerantias* Robertson, 1903), *Eumegachile* Friese, 1898, and in the new subgenus *Mitchellapis*.

The bees of this genus make cells, usually in series, from pieces cut from leaves of plants. Descriptions of nests of Australian species exist in the following works: Hacker, 1915; Rayment, 1933, 1935, 1953a, 1953c.

KEY TO THE SUBGENERA OF *Megachile* OF THE AUSTRALIAN REGION

1. Mandible of female without cutting edge in third interval; carina of sixth tergum of male neither serrate nor emarginate, but with one median tooth. *Mitchellapis*
 Mandible of female with cutting edge in third interval; carina of sixth tergum of male emarginate medially, in some cases emargination almost obscured by coarse dentation 2
2. Species with fulvous and black coloration suggestive of *Callomegachile*; third mandibular tooth of female broad and irregularly truncate, second (in ours) obliquely truncate or sinuate at apex; cutting edge in second interval absent (perhaps fused with third tooth); apical margin of sixth tergum of male with four widely separated small teeth *Callochile*
 Usually dull colored, gray, often with pale metasomal bands of hair; third mandibular tooth of female, as well as second, angulate, cutting edge in second interval usually present, although incomplete; apical margin of sixth tergum of male with small lateral teeth only, in some cases weak indications of two other teeth. *Eutricharaea*

SUBGENUS EUTRICHARAEA THOMSON

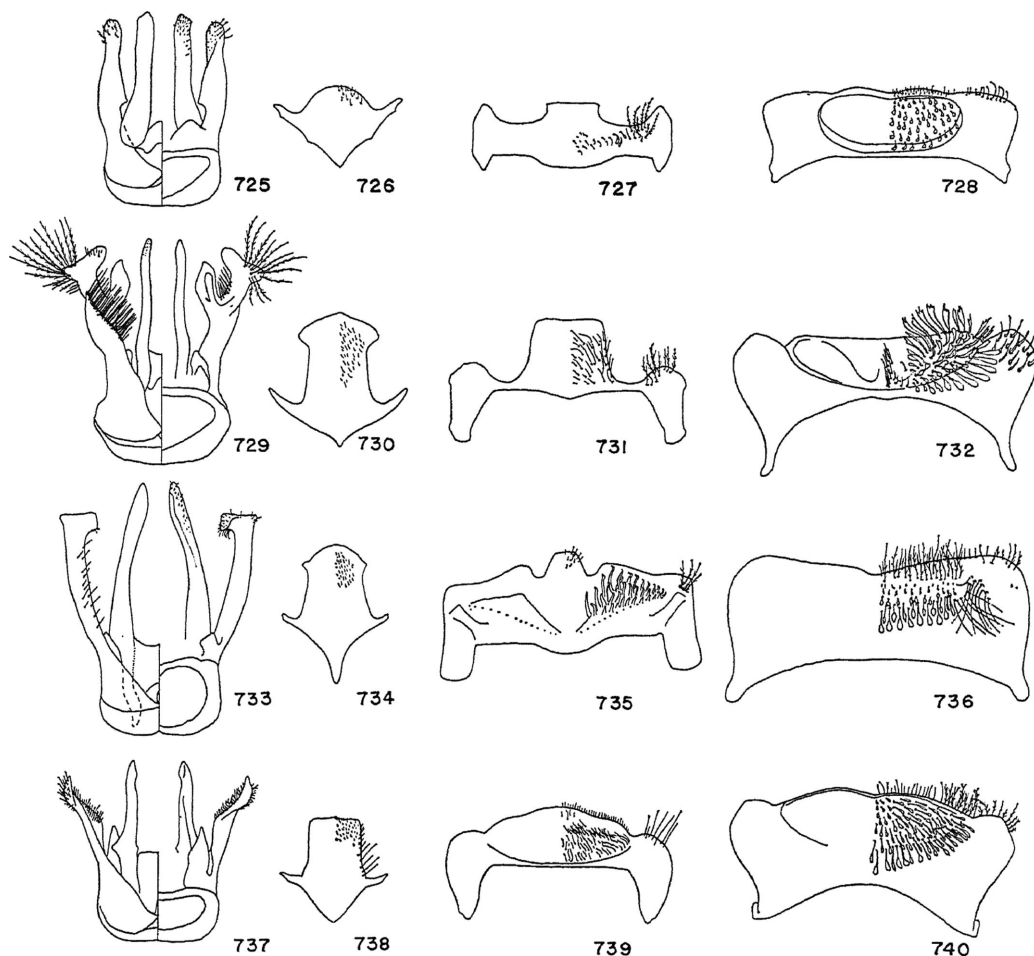
Text figures 725-732, 741-747

Eutricharaea THOMSON, 1872, p. 228. Type: *Apis argentata* Fabricius, 1793 (monobasic).

Paramegachile FRIESE, 1898b, p. 198. Type: *Apis argentata* Fabricius, 1793 (designation of Mitchell, 1934, p. 298)

Androgynella COCKERELL, 1911e, p. 313. Type: *Megachile detera* Cockerell, 1910 (monobasic and original designation). New synonymy.

This subgeneric name is here used in a possibly composite sense to include a group of *Megachile* ordinary in appearance. At least until the sexes of more species are associated



FIGS. 725-740. Male genitalia and eighth, sixth, and fifth sterna of Megachilinae. 725-728. *Megachile* (*Eutricharaea*) *detersa*. 729-732. *M.* (*E.*) *chrysopyga*. 733-736. *M.* (*Callochile*) *mystacea*. 737-740. *M.* (*Mitchellapis*) *fabricator*.

this procedure is practical; in any event it may be that *Megachile* as here understood has been more finely split than necessary by recent authors. A decision must be postponed until the Eurasian and African species have been more fully studied.

Some of the Australian species (*serricauda* and its relatives) are certainly closely allied to *argentata*, the type species of the subgenus. For others (those representatives of group *a* below that have the mandible of the female quadridentate, lack a basal mandibular projection in the male, and have the carina of the sixth tergum not coarsely serrate) the name *Androgynella* is available, even though it was

proposed for what were probably a group of sexually anomalous individuals of *M. ciliatipes*. There are various combinations of these characters, so that for the present they are not regarded as distinguishing another subgenus.

For some reason sexually anomalous individuals in *Megachile* are especially numerous (see Mitchell, 1929). My present interpretation of *Androgynella* is that it is based on such individuals, but the fact remains that normal females of the species have not yet been recognized. I have seen a specimen of *Callochile* from New Guinea with all the peculiar intersexual characters of *Androgynella*,

and Cockerell described a species from the Philippines, giving it the same specific name as the *Megachile* that it resembles.

Rather small to moderate sized, broad bodied; posterior part of thorax as in *Megachile* proper.

FEMALE: Mandible quadridentate, usually with incomplete cutting edge in second interval, in some so narrow as to be entirely hidden under edge of third tooth, and in others (*insularis*, *similis*, *ventralis*, *zingowli*) absent; with complete or incomplete cutting edge in third interval; inner angle of mandible usually acute, in some truncate, but in *chyzeri* and *minutula* from New Guinea and in group *c* this portion emarginate so that mandible is five-toothed; first flagellar segment shorter than next. Middle basitarsus slightly shorter than tibia and nearly as broad; hind basitarsus markedly shorter than tibia and nearly as broad; claws with basal spicule. Metasoma broad, sixth tergum slightly concave in profile, lateral margins scarcely concave seen from above, surface with suberect hairs, in some cases tomentose; sterna with apical pubescent bands complete, present only laterally (*insularis*, *zingowli*), only at extreme sides of second and third sterna (*doleschalli*), only at extreme sides of second or third sternum (e.g., *similis*), or completely absent (*ventralis*, *shortlandi*, *ignescens*, *rhodogastra*), sixth sternum without bare area or rim.

MALE: Mandible tridentate (*serricauda*, *cetera*, group *b*) or quadridentate (*ciliatipes*, *detersa*, *rhodogastra*, *austeni*, *shortlandi*), with (*similis*, *zingowli*, *serricauda*, group *b*) or without (*ciliatipes*, *dampieri*, *detersa*, *rhodogastra*, *kurandensis*, *austeni*, *shortlandi*) inferior basal projection; first flagellar segment shorter than second. Front coxa (groups *a* and *c*) hairy on anterior surface (sparsely so in *ciliatipes*, *dampieri*, *detersa*, and *tenuicincta*), without rufescent bristles, with apical spine in *serricauda*, *ciliatipes*, *similis*, *dampieri*, *zingowli*, *detersa*, *tenuicincta*, lacking spine in *rhodogastra*, *shortlandi*, *kurandensis*, and *austeni*, in group *b* with anterior surface bare, with patch of rufescent bristles; fore femur unmodified in groups *a* and *c*, smooth and flat or concave in group *b*; anterior tarsus in groups *a* and *c* unmodified, or slightly broadened in *dampieri*, *ciliatipes*, *fullawayi*,

tenuicincta, and *detersa*, in group *b* much enlarged except for *diligens* and allies in which it is little enlarged; middle tibial spur present and movable; middle claws symmetrical or slightly asymmetrical; middle and hind basitarsi about half as long as respective tibiae or less, not modified. Carina of sixth tergum with median emargination, in some species (*serricauda*, *fullawayi*) almost obscured by coarse serration, in group *b* commonly with emargination large so that there are two large teeth on each side of it, in some cases with small median tooth between them; margin of sixth tergum with small tooth at side, no submedian teeth or rarely with very feeble ones; metasoma with four exposed sterna; fifth sternum with recognizable medasternite with somewhat specialized vestiture; sixth sternum only moderately to strongly narrowed laterally, vestiture sparse, medasternite not or weakly defined; eighth usually short, invariably without hairs along lateral margins; gonocoxite not lobed to much lobed apically.

The species are segregated into three groups in the accompanying list. Group *a* is probably an artificial assemblage, and group *b* may also be; group *c* is perhaps a single species. In group *a* the mandible of the female is usually four-toothed, the fore coxa of the male is hairy without rufescent bristles and with or without an apical spine and the mandibles of the male are with or without a basal projection. In group *b* the mandibles of the female are four-toothed; the fore coxae of the male have the anterior surface nearly bare, with a patch of rufescent bristles, and there is a large apical spine; the mandible of the male has an inferior basal projection. The species of this group are commonly larger than those of groups *a* and *c* and the sixth tergum of the female more commonly has pale tomentum. In group *c* the mandibles of the female are five-toothed, the fore coxae of the male are unspined, the mandibles of the male lack a basal projection, and the scutellum in both sexes is unusually protuberant medially.

Megachile waterhousei and *rowlandi*, known to me from a single female each, are placed in group *b* with hesitation, since they lack the cutting edge of the mandible in the second interspace. Their rather large size and the tomentose sixth tergum of *waterhousei* sug-

gest placement here rather than in group *a*, some species of which also lack the cutting edge mentioned.

Species with brightly colored metasomal pubescence (e.g., *doleschalli*, *dampieri*, which are probably sexes of one species) seem out of place in *Eutricharaea*, superficially more closely resembling *Callochile* and even *Callo-megachile*. A subgeneric study of Asiatic *Megachile* will be necessary to determine whether such species are correctly placed. [Lieftinck has pointed out that some and perhaps all of the bees described by Cockerell (1907a) from Ambon were mislabeled; the two *Eutricharaea* with brightly colored pubescence are among these and may well not belong to our area.]

DISTRIBUTION: Continents of the Eastern Hemisphere, including the Palearctic as well as more southern faunal areas; present in the Western Hemisphere probably entirely as a result of introduction within historic times. In our area: Australia (all areas), New Caledonia, Loyalty Islands, New Hebrides, Fiji, Tonga, Samoa, Tahiti, Phoenix Islands, Solomon Islands, Bismarck Archipelago, New Guinea, Aru, Ambon, Indonesia.

INCLUDED SPECIES

- Megachile* (*Eutricharaea*) (b) *albomarginata* Smith, 1879 (B.M.) New Caledonia
annae Friese, 1908 (desc.) New Guinea
 (b) *armstrongi* Perkins and Cheesman, 1928 (B.M.) Samoa
 (a) *aurantiscopa* Krombein, 1949 (U.S.N.M.) Solomon Islands
 (a) *austeni* Cockerell, 1906b (B.M.)
 (b) *australasiae* Dalla Torre, 1896 = *imitata* Smith, 1868a (not 1853) (B.M.)
 (b) *australis* Lucas, 1876 New Caledonia
 (b) *buxtoni* Perkins and Cheesman, 1928 (B.M.) Samoa
 (b) *calens* Cockerell, 1914i (U.S.N.M.) New Hebrides
 (b) *capitonis* Cockerell, 1914i (B.M.)
 (a) *cetera* Cockerell, 1912b (C.S.I.R.O.)
 (b) *chrysopyga* Smith, 1853 (B.M.)
 (b) *chrysopygopsis* Cockerell, 1929d (Q.M.)
 (a) *chyzeri* Friese, 1909 New Guinea
 (a) *ciliatipes* (Cockerell, 1921 (B.M.)
cingulata Friese, 1903a Kai
 (b) *cygnorum* Cockerell, 1906b (B.M.)
 (a) *dampieri* Cockerell, 1907a (A.M.N.H.) Ambon
 (b) *darwiniana* Cockerell, 1906b (B.M.)
 (a) *detersa* Cockerell, 1910h (B.M.)
 (a) *disputabilis* Krombein, 1951 (U.S.N.M.) Solomon Islands
 (b) *doanei* Cockerell, 1908a (B.M.) Tahiti
 (a) *doleschalli* Cockerell, 1907a (A.M.N.H.) Ambon
 (a) *dubiosa* Friese, 1909 (H.N.M.) New Guinea
 (c) *fimbriiventris* Friese, 1911a Fiji
 (a) *fullawayi* Cockerell, 1914e (U.S.N.M.) Guam, Hawaii, south to Phoenix Islands (where possibly introduced on Canton Island)
fulvifrons Alfken, 1926 Buru
 (b) *gahani* Cockerell, 1906b (B.M.)
 (a) *glaberrima* Friese, 1911a (desc.)
 (a) *haematogastra* Cockerell, 1921 (Q.M.)
 (b) *hampsoni* Cockerell, 1906b (B.M.)
 (b) *hedleyi* Rainbow, 1897 Ellice Islands
 (a) *ignescens* Cockerell, 1929a (A.M.N.H.)
 (a) *insularis* Smith, 1859b (B.M.) (Ox.) Aru
 (a) *kurandensis* Cockerell, 1910e (B.M.)
 (a) *kuschei* Cockerell, 1939 (Bishop)
 (a) *leucopogon* Cockerell, 1929a (A.M.N.H.)
 (b) *lineatipes* Cockerell, 1910e (B.M.)
 (b) *maculariformis* Cockerell, 1907a (A.M.N.H.)
 (b) *macularis* Dalla Torre, 1896 = *maculata* Smith, 1853, p. 170 (not p. 160) (B.M.)
 (a) *minutula* Friese, 1911b, New Guinea, New Britain
 (a) *obtusa* Smith, 1853 (Ox.)
 (b) *papuana* Cockerell, 1929c (A.M.) New Guinea
 (b) *phenacopyga* Cockerell, 1910i (Berlin*)
 (a) *pictiventris* Smith, 1879 (B.M.)
 (a) *quinquelineata* Cockerell, 1906b (B.M.)
 (a) *rhodogastra* Cockerell, 1910h (B.M.)
 (b) *rowlandi* Cockerell, 1930a (U.S.N.M.)
 (a) *rufopilosa* Friese, 1911a (desc.)
 (c) *scutellata* Smith, 1879 (B.M.) "South Sea Islands," known from Tonga and Fiji
 (a) *secunda* Dalla Torre, 1896 = *senex* Smith, 1862a (not 1853 or 1864) (?Ox.)
 (a) *sequior* Cockerell, 1910i (Berlin*)
 (a) *serricauda* Cockerell, 1910e (B.M.)
 (a) *shortlandi* Cockerell, 1911b (C.S.I.R.O.) Solomon Islands
 (a) *similis* Smith, 1879 (B.M.) New Hebrides
 (a) *simplex* Smith, 1853 (B.M.)
 (a) *subsericeicauda* Rayment, 1939 (C.S.I.R.O.)
 (a) *tenuicincta* Cockerell, 1929a (A.M.N.H.)
 (c) *tutuila* Perkins and Cheesman, 1928 (B.M.) Samoa
 (b) *vavauensis* Cockerell, 1924 (B.M.) Tonga
 (a) *ventralis* Smith, 1861 (Ox.) Ambon
 (b) *waterhousei* Cockerell, 1906b (B.M.)
 (c) *wilmattae* Cockerell, 1924 (paratype U.S.-N.M.) Samoa
 (a) *woodfordi* Cockerell, 1911b (B.M.) Solomon Islands

- (a) *wyndhamensis* Rayment, 1935 (C.S.I.R.O.)
 (a) *zingowli* Cheesman, 1936 (B.M.) New
 Hebrides

SUBGENUS **Callochile** MICHENER

Text figures 733-736, 748-750

Callochile MICHENER, 1962a, p. 27. Type: *Megachile ustulatifomis* Cockerell, 1910 = *Apis mystacea* Fabricius, 1775 (original designation).

This subgenus contains large species of broad-bodied *Megachile* in which the metasomal terga, instead of being provided with apical bands of pale pubescence, have more or less extensive areas of orange tomentum. Superficially, therefore, if body shape (sometimes deceptive) is ignored, these species often resemble those of the subgenus *Callo-megachile* of *Chalicodoma*. The terga have strong transverse postgradular grooves. The mandibles of the female are unusually broad, with the second and third teeth broad, thin, the third especially so, and truncate. The broad mandibles, with long sharp edges, are superficially suggestive of the African *Ame-gachile*, in which, however, the sharp edges are extraordinarily well-developed cutting edges, the teeth proper being pointed.

Large, broad-bodied species; posterior part of thorax as in other *Megachile*.

FEMALE: Mandible quadridentate, with long, complete, cutting edge in third interval, *third tooth irregularly and broadly truncate, second* (in our forms) *obliquely truncate*; first flagellar segment about two-thirds as long as second; middle and hind basitarsi both distinctly shorter than respective tibiae, hind nearly as broad as to broader than tibia, claws each with small basal spicule. Metasoma broad, sixth tergum slightly concave in profile, lateral margins slightly concave seen from above, surface with suberect hairs and (like other parts of metasoma) orange tomentum; sterna without apical pubescent fasciae, the sixth without large hairless area but hairs short apically, no bare rim.

MALE: Mandible four-toothed, with inferior basal projection; first flagellar segment less than half of length of second. First coxa with anterior face nearly bare, no rufescent bristles, apical spine large; anterior tarsus slightly enlarged; middle tibial spur present and movable; middle claws asymmetrical; middle and hind basitarsi about half of

lengths of respective tibiae. Carina of sixth tergum rounded, with small median emargination; apical margin of sixth tergum with four small teeth, distance between submedian ones slightly greater than distance from one of them to lateral tooth; metasoma with four exposed sterna, fifth with short medasternal area provided with specialized capitate hairs; sixth not narrowed sublaterally, medasternal area represented by a shelflike expansion on each side of disk of sternum and bearing coarse, immovable, capitate processes; eighth sternum without hairs on lateral margins; gonostylus somewhat enlarged and slightly lobed at apex.

DISTRIBUTION: Southern to northern Queensland, Solomon Islands, New Guinea, Indonesia, Malaya, Indochina, Philippine Islands, India.

INCLUDED SPECIES

- Megachile* (*Callochile*) *bougainvilliana* Strand, 1911a Solomon Islands
butonensis Friese, 1909 (H.N.M.) New Guinea. Although named for a region near Celebes, Friese's first locality is in New Guinea and the specimen in the Hungarian National Museum is from New Guinea
cartereti Cockerell, 1911b (C.S.I.R.O.) Solomon Islands
ferricincta Cockerell, 1939 (Bishop) Solomon Islands
foliata Smith, 1861 (Ox.) Batjan
hilli Cockerell, 1929a (A.M.N.H.)
mystacea (Fabricius,¹ 1775) (*Apis*) (B.M.)
nigrohirta Friese, 1903b ("*typus*" W.) New Britain, New Guinea
othona Cameron, 1901 (B.M.) New Britain
placida Smith, 1862b (Ox.) Halmahera
puncticollis Friese, 1903b (H.N.M.) Buru, Ambon
rufocaudata Friese, 1903b Kai
ustulatifomis Cockerell, 1910h (B.M.)

Outside our area, the following species have been recognized as belonging to this subgenus: *bicolor* Fabricius (India); *labascens* Cockerell (Philippine Islands); *rhododendri* Cockerell (Malaya); *saigonensis* Cockerell (Indochina).

¹ This is not *mystacea* of most authors, which is a *Callo-megachile*. The type in the Banks Collection, British Museum (Natural History), is a *Callochile* and apparently identical to *ustulatifomis* which therefore falls in synonymy.

MITCHELLAPIS, NEW SUBGENUS

Text figures 737-740, 751-756

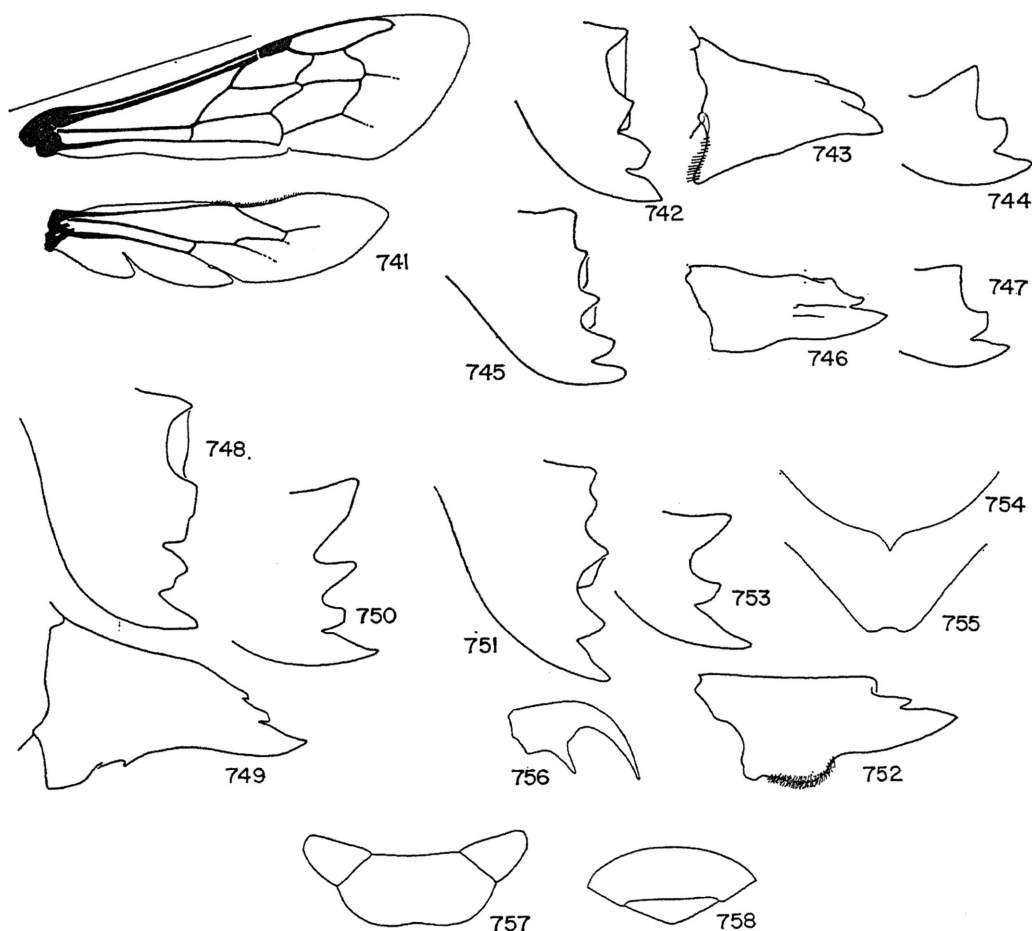
TYPE: *Megachile fabricator* Smith, 1868.

This subgenus resembles *Sayapis* in being a form with pale pubescence, parallel-sided metasoma, with a cutting edge in the second mandibular interval only. It differs from *Sayapis* in having apical bands of hair on the sterna (laterally) of the female like those of *Eutricharaea*, in the median spine on the carina of the sixth tergum of the male, and in various other characters, described below.

Rather large, broad but parallel-sided spe-

cies; posterior part of thorax about as in other *Megachile*, although axillar fossa deeper than usual in that group.

FEMALE: Mandible five-toothed, with *incomplete cutting edge in second interval*; *no other cutting edge*; inner apical angle of mandible acute; first flagellar segment shorter than second. Middle and hind basitarsi shorter than corresponding tibiae and slightly narrower; claws with strong basal tooth. Metasoma parallel sided, sixth tergum concave apically, lateral margins about straight seen from above, *apex broadly bilobed*, surface



FIGS. 741-758. Megachilidae. 741. Wings of *Megachile (Eutricharaea) chrysopyga* (scale line represents 5 mm.). 742-744. Apex of female mandible, outer side of male mandible, and apex of male mandible of *M. (E.) chrysopyga*. 745-747. Same of *M. (E.) scutellata*. 748-750. Same of *M. (Callochile) mystacea*. 751-753. Same of *M. (Mitchellapis) fabricator*. 754. Carina of sixth tergum of male of *M. (M.) fabricator*. 755, 756. Apex of sixth tergum and claw of female of *M. (M.) fabricator*. 757, 758. Dorsal view of scutellum and sixth and seventh terga of male of *Anthidiellum melanaspis*.

with suberect hairs, not tomentose; *sterna 2 to 4 with apical hair bands laterally*; sixth sternum with midapical bare area but scopa on base and at sides nearly to apex, apex with short hairs, without rim.

MALE: Mandible tridentate, with rounded inferior basal projection covered with brush of short black hairs. First flagellar segment less than half as long as second; first coxa with anterior surface only sparsely hairy, apex with spine and patch of very minute rufescent bristles; anterior tarsi much enlarged, first segment very long, prolonged apically on anterior side of second and third segments so that total length of first is more than twice that of second and third taken together; middle tibial spur present; middle claws symmetrical; middle and hind basitarsi more than half as long as corresponding tibiae, slender, unmodified. *Carina of sixth tergum little produced, broadly rounded except for median spinelike projection*; rear margin of sixth tergum simple; metasoma with four exposed sterna; fifth sternum with medasternal area bearing specialized, capitate hairs; sixth little narrowed sublaterally, medasternal area recognizable but with simple hairs; eighth sternum with long hairs along lateral margins; gonocoxite with apical part slightly broadened and twisted but not lobed.

DISTRIBUTION: Queensland and Western Australia.

INCLUDED SPECIES

Megachile (Mitchellapis) batchelori Cockerell, 1929d (Q.M.)
conaminis Cockerell, 1926a (N.M.V.)
fabricator Smith, 1868a (B.M.)
fuscitarsis Cockerell, 1912b (B.M.)
semiclara Cockerell, 1929d (Q.M.)
vestitor Cockerell, 1910i (Berlin*)

GENUS COELIOXYS LATREILLE

The genus *Coelioxys* is easily recognized among the megachilids of our area by the pointed axillae and the tapering, conical metasoma, that of the female ending with the much-attenuated last sternum. It consists of parasites, most of which inhabit nests of *Megachile*. Since that genus is abundant in Australia, the scarcity of *Coelioxys* is surprising. *Coelioxys albiceps* is reported as a parasite of *Ctenoplectra* (Fries, 1909), but this report is certainly an error; Lieftinck (*in*

litt.) says it is probably a parasite of *Callo-megachile*. *Coelioxys smithii* is probably a parasite of *Creightoniella* (Michener and Szent-Ivany, 1960); van der Meer Mohr (1929) reported it as a parasite of *C. atrata* (incorrectly identified as *Megachile tuberculata*) in Sumatra.

The classification of *Coelioxys* is in a primitive state. Several groupings, comparable to those of *Megachile*, could well be recognized among species here placed in *Coelioxys*, *sensu stricto*. In view of the very small fauna of our area, this does not seem to be the time or the place to publish the studies necessary for recognition of such groups.

KEY TO THE SUBGENERA OF *Coelioxys*

Eyes hairy *Coelioxys*, *sensu stricto*
 Eyes bare *Liothyrapis*

SPECIES OF *Coelioxys* NOT PLACED IN THE CLASSIFICATION

amboinensis Dusmet y Alonso, 1915 (desc.) Ambon

SUBGENUS COELIOXYS LATREILLE, SENSU STRICTO

Coelioxys LATREILLE, 1809, p. 166. Type: *Apis conica* Linnaeus, 1758 (designation of Latreille, 1810, p. 439).

DISTRIBUTION: All continents, Indonesia, New Guinea, Solomon Islands, Australia south to Victoria, west to Western Australia.

INCLUDED SPECIES

Coelioxys (Coelioxys) albolineata Cockerell, 1905b (B.M.)
biroi Friese,¹ 1909, New Guinea
darwinensis Cockerell, 1929a (A.M.N.H.)
dispersa Cockerell, 1911b (B.M.) Solomon Islands
froggatti Cockerell, 1911b (U.S.N.M.)
peregrinata Cockerell, 1911b (C.S.I.R.O.) Solomon Islands
reginae Cockerell, 1905b (B.M.)
smithii Dalla Torre, 1896 = *intrudens* Smith, 1861, p. 132 (not p. 92) (Ox.) Batjan
victoriae Rayment, 1935 (C.S.I.R.O.)

SUBGENUS LIOTHYRAPIS COCKERELL

Liothyrapis COCKERELL, 1911d, p. 246. Type: *Coelioxys apicata* Smith, 1854 = *C. decipiens* Spinola, 1836 (monobasic).

DISTRIBUTION: Africa, southern Asia to the

¹ Subgeneric placement thanks to Dr. M. A. Lieftinck.

Philippine Islands, Malaya, Indonesia, New Guinea, Queensland, New South Wales.

INCLUDED SPECIES

Coelioxys (*Liothyrapis*) *albiceps* Friese, 1909
("typus" W.) New Guinea
weinlandi Schulz, 1904 (B.M.) New Guinea

The two names listed above are probably synonymous; records for Queensland exist under both.

TRIBE ANTHIDIINI

This tribe is very poorly represented in our area. Our two genera both differ from our representatives of the Megachilini (in addition to the characters given in the key to the tribes) in having a sharp carina separating the anterior from the lateral surfaces of the mesepisterna, in having the scutellum produced posteriorly as a broad shelf overhanging the metanotum and propodeum which are vertical in profile, and in having the second recurrent vein distal to the second transverse cubital.

KEY TO THE GENERA OF THE ANTHIDIINI OF THE AUSTRALIAN REGION

Head, thorax, and metasoma with yellow maculations; scopa of female present on sternum *Anthidiellum*
Body not maculate, metasoma in ours red; scopa of female absent *Parevaspis*

GENUS ANTHIDIELLUM COCKERELL

Text figures 757, 758

Anthidiellum COCKERELL, 1904c, p. 3. Type: *Trachusa strigata* Panzer (original designation).
Ceri-anthidium FRIESE, 1923, p. 304. Type: *Trachusa strigata* Panzer (designation of Cockerell, 1925b, p. 361).

This genus of small, very robust, yellow and black or red and black, maculate bees is found in all continents. One of its distinctive features is the outwardly arcuate subantennal sutures. For a tabulation of other characters, see Michener (1948). This is the only genus of nonparasitic Anthidiini that reaches our area, and it is represented in this region only by the very distinctive subgenus *Pycnanthidium*, a widespread Paleotropical group that might well be regarded as a genus, although it seems best to me at the moment to include it in *Anthidiellum*.

Australian species have sometimes, incor-

rectly, been included in the genus *Dianthidium*.

Nests of *Anthidiellum* are not known from our area, but in other continents other subgenera make resin cells, isolated or in groups, attached to rocks or other surfaces.

SUBGENUS PYCNANTHIDIUM KROMBEIN

Pycnanthidium KROMBEIN, 1951, p. 292. Type: *Pycnanthidium solomonis* Krombein, 1951 (original designation).

Among the characters by which this subgenus differs from *Anthidiellum*, *sensu stricto*, are the following: preoccipital carina absent; scutellum produced posteriorly but not truncate; seventh tergum of male simple, blunt; fifth sternum of male with a comb of close, fine, black teeth along apical margin.

The anterior outer margin of the hind tibia and the outer surface of the hind basitarsus each has a longitudinal carina. This character is shared with *Parevaspis* and with *Icteranthis*, an otherwise rather different Palearctic genus.

DISTRIBUTION: The subgenus is found in Africa, India, Thailand, China, Indonesia, New Guinea, the Solomon Islands, and northern and central Queensland.

INCLUDED SPECIES

Anthidiellum (*Pycnanthidium*) *biroi* (Friese, 1909) (*Anthidium*) n. comb. (desc.) New Guinea
melanaspis Cockerell, 1929f (B.M.)
solomonis (Krombein, 1951) (*Pycnanthidium*) n. comb. (C.A.S.) Solomon Islands
turneri (Friese, 1909) (*Anthidium*)

From outside our area, I have seen apparently authentic material of these species of *Pycnanthidium*: *absonulum* Cockerell, *aspidopodum* Mavromoustakis, *hessei* Cockerell, *lautulum* Cockerell, *medionigrum* Cockerell, *ramakrishnae* Cockerell, *rasorium* (Smith), *rufipes* (Smith), *swalei* Mavromoustakis, and *zebra* (Friese). According to Krombein (1951), *javanicum* (Friese) [= *minutissimum* (Bingham)] also belongs here. *Anthidiellum smithii* Ritsema from Java is also a member of this group.

GENUS PAREVASPIS RITSEMA

Parevaspis RITSEMA, 1874, p. lxxi. Type: *Parevaspis basalis* Ritsema, 1874 (designation of Sandhouse, 1943, p. 585).

This genus contains moderate-sized, black, parasitic bees, ours with the metasoma red. The females lack a scopa. *Parevaspis* is related to *Stelis* of other continents and, as I said in 1944, is questionably distinct from *Stelis*.

According to Lieftinck (1939) these bees seem to be parasitic in nests of *Lithurge*. Meyer (1921a) discussed the distribution and noted Bingham's statement that our species parasitizes *Megachile*.

DISTRIBUTION: India, China, Japan, Indonesia, Buru, Batjan, and Kai.

I have not seen specimens from our area.

INCLUDED SPECIES

Parevaspis abdominalis (Smith, 1859a) (*Stelis*)
= *polyesia* Vachal, 1903 = *smithi* Friese, 1904
(*Eusaspis*) (Ox.) Indonesia

FAMILY ANTHOPHORIDAE

This family, which is large and diversified in other continents, is poorly represented in our area. Our three subfamilies can be separated by the following key.

KEY TO THE SUBFAMILIES OF THE ANTHOPHORIDAE OF THE AUSTRALIAN REGION

1. Pygidial plate absent or represented by apical spine, usually hidden in dense pubescence; clypeus not strongly protuberant, lateral parts seen from below but little bent back and not parallel to long axis of body Xylocopinae
- Pygidial plate present in female; clypeus strongly protuberant so that, seen from below, lateral parts are bent back parallel to long axis of body 2
2. Marginal cell longer than distance from its apex to wing tip and pointed on wing margin; stigma large, extending well into marginal cell beyond base of vein r; small, slender bees Nomadinae
- Marginal cell shorter than distance from its apex to wing tip, apex of cell rounded and separated from wing margin; stigma small, not extending into marginal cell beyond base of vein r; robust species . . . Anthophorinae

SUBFAMILY NOMADINAE

Numerous tribes of this subfamily occur on other continents. Only the tribe Nomadini reaches our area, and it is represented there by a single genus, *Nomada*. All species of the

subfamily are parasitic. The most closely related non-parasitic bees are probably in the tropical American tribe Exomalopsini of the subfamily Anthophorinae.

GENUS NOMADA SCOPOLI

Text figure 759

Nomada SCOPOLI, 1770, p. 44. Type: *Apis ruficornis* Linnaeus, 1758 (designation of Curtis, 1832, p. 419).

This widespread genus of parasitic bees is related to the Exomalopsini of tropical America, on which it is almost surely parasitic in that area. In the Holarctic Region most species parasitize *Andrena*, although some are said to attack *Lasioglossum*. The very small intrusion of the genus into our area must be possible because of parasitism on *Lasioglossum* or some other small bees.

The genus is a large and diversified one, the classification of which is not well understood in spite of the existence of several subgeneric names. The species of our area all belong to a small group which seems definitely to fall within the genus *Nomada*, but its position with relation to named subgenera is unresolved.

Our species are rather small, slender, wasp-like insects, with the pubescence short and with no scopa. Identification can easily be made by means of the drawing of the wing venation.

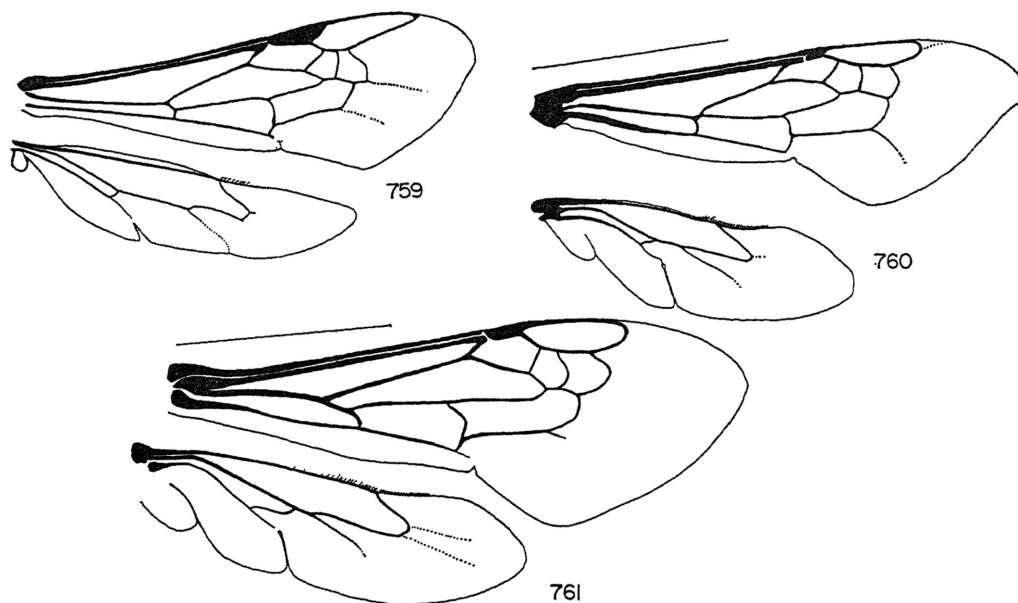
DISTRIBUTION: All continents, India, Philippine Islands, Indonesia, Timor, New Guinea, Solomon Islands, northern to southern Queensland.

INCLUDED SPECIES

Nomada australensis Perkins, 1912 (B.M.)
biguttata Friese, 1909 (desc.) New Guinea
biroi Friese, 1909 (desc.) New Guinea
dahli Friese, 1912a (desc.) Bismarck Archipelago
insularis Smith, 1863 (Ox.) Seram
nigrescens Friese, 1909 (desc.) New Guinea
papuana Cockerell, 1933b (B.M.) New Guinea
psilocera Kohl, 1908 (W.*) Solomon Islands
rubinii Rayment, 1930b (*Neoceratina*) (C.S.-I.R.O.)

SUBFAMILY ANTHOPHORINAE

This subfamily is most diversified in the Americas, less so in Eurasia and Africa, and only two tribes reach our area.



FIGS. 759-761. Wings of Nomadinae and Anthophorinae. 759. *Nomada australensis*. 760. *Amegilla* (*Asaropoda*) *bombyiformis*. 761. *Thyreus macleayi*. Scale lines represent 5 mm.

KEY TO THE TRIBES OF THE ANTHOPHORINAE OF THE AUSTRALIAN REGION

- Second abscissa of vein M+Cu of posterior wing
shorter than cu-v; scopa absent; claws with
large, flattened, inner basal tooth or lobe . . .
. Melectini
- Second abscissa of vein M+Cu of posterior wing
at least as long as cu-v; scopa present; claws
cleft in males, with slender inner tooth in females
. Anthophorini

TRIBE ANTHOPHORINI

This tribe contains the pollen-collecting bees most closely related to, and serving as hosts for, the species of the Melectini.

GENUS AMEGILLA FRIESE

Text figures 760, 762-765

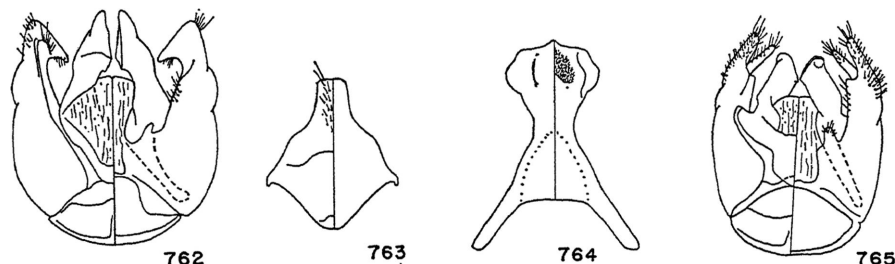
This genus contains moderate-sized to very large, robust, fast-flying bees, which in Australia have traditionally gone under the generic names *Anthophora* and *Asaropoda*. Popov (1950), Lieftinck (1956), and Michener (1960b) have indicated that the species of our area are properly placed in *Amegilla*. *Amegilla* differs from *Anthophora* by the lack of arolia and by various other characters as indicated by Popov. *Anthophora* is found in all

continents except Australia; *Amegilla*, in all the continents of the Eastern Hemisphere.

The bees of this genus nest in soil, commonly in banks but sometimes in flat ground, and commonly in aggregations. Each burrow ends in a small number of cells provisioned with viscous, strong-smelling material. The cell wall and inner surface of the plug that closes the cell, except for a median pore, are thinly lined with a waxy material. The mature larvae spin no cocoons. References to observations on nests of Australian species are given separately under the subgenera.

KEY TO THE SUBGENERA OF *Amegilla*

- Most or all closed cells of forewing with some rather long hairs; gonostylus of male unrecognizable, apices of gonoforceps triangular, directed inward; maxillary palpus six-segmented, last segment more than half as long as fifth *Amegilla*
- Forewing conspicuously hairy near costal margin (or not at all), other closed cells with hairs sparse or absent; gonostylus of male distinct, slender, and directed apically; maxillary palpus with last segment reduced, usually less than half as long as fifth, often absent so that palpus is five-segmented *Asaropoda*



FIGS. 762-765. Anthophorinae, Anthophorini. 762-764. Genitalia and eighth and seventh sterna of *Amegilla* (*Amegilla*) *salteri*, male. 765. Genitalia of *A.* (*Asaropoda*) *bombiformis*, male.

SUBGENUS AMEGILLA FRIESE, SENSU STRICTO

Text figures 762-764

Amegilla FRIESE, 1897b, pp. 5, 18. Type: *Apis quadrifasciata* Villers, 1789 (designation of Cockerell, 1931b, p. 277).

Alfkenella BÖRNER, 1919, p. 168. Type: *Apis quadrifasciata* Villers, 1789 (original designation).

Zonamegilla POPOV, 1950, p. 260. Type: *Apis zonata* Linnaeus, 1758 (original designation). New synonymy.

The species of this subgenus usually have blue or white apical bands of appressed pubescence on the metasomal terga, although some have widespread brown and green pubescence on the metasoma. Some species from New Guinea, the Solomon Islands, and Indonesia have brown metasomal bands, but they are narrow like the bands of the blue-and-white-banded species, not broad as in the banded species of *Asaropoda*.

Information on the bionomics of Australian species of *Amegilla*, *sensu stricto*, was given by Rayment (1935, 1944) and Michener (1960b). In connection with the last reference it should be noted that figure 3 was printed on its side: the right-hand end of the figure as printed should be at the top.

DISTRIBUTION: Europe, Africa, Asia, to the Philippine Islands, Indonesia, New Guinea, the Solomon Islands, and all parts of Australia (not known from Tasmania).

INCLUDED SPECIES

Amegilla (*Amegilla*) *adamsella* (Rayment, 1944) (*Anthophora*) n. comb. (desc. C.S.I.R.O.)
adelaidae (Cockerell, 1905j) (*Anthophora*) (B.M.)
aeruginosa (Smith, 1854) (*Anthophora*) n. comb. (B.M.)
asserta (Cockerell, 1926b) (*Anthophora*) (paratype, M.C.Z.)

assertiella (Rayment, 1947b) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
aurata (Friese, 1911a) (*Anthophora*) n. comb. (desc.) New Britain
australis (Rayment, 1944) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
berylae (Rayment, 1947b) (*Anthophora*) n. comb. (desc.)
buruensis (Cockerell, 1911d) (*Anthophora*) (Berlin*) Buru
cinctofemorata (Sichel, in Dours, 1869)¹ (*Anthophora*)
cingulata (Fabricius, 1775) (*Andrena*)
chlorocyanea (Cockerell, 1914i) (*Anthophora*)
confusa (Smith, 1854) (*Anthophora*) n. comb.
 India, incorrectly reported from New Guinea
darwini (Cockerell, 1910h) (*Anthophora*) (B.M.)
elegans (Smith, 1859b) (*Anthophora*) n. comb. (Ox.) Kai
emendata (Smith, 1879) (*Anthophora*) n. comb. (B.M.)
ernesti (Rayment, 1944), described as new 1947b (*Anthophora*) n. comb. (desc.)
fabriciana (Rayment, 1947b) (*Anthophora*) n. comb. (desc.)
ferrisi (Rayment, 1947b) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
gilberti (Cockerell, 1905j) (*Anthophora*) n. comb. (B.M.)
grayella (Rayment, 1944) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
hackeri (Rayment, 1947b) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
holmesi (Rayment, 1947b) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
jamesi (Rayment, 1944) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
lilacine (Cockerell, 1921) (*Anthophora*) (Q.M.)

¹ This name was based on a headless specimen that was not an anthophorid according to Dr. M. A. Lieftinck; perhaps it was a *Nomia*. It is listed here because its proper place remains unknown.

- longmani* (Rayment, 1947b) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
longula (Rayment, 1947b) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
luteola (Rayment, 1944) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
mcnamarae (Cockerell, 1929c) (*Anthophora*) n. comb. New Guinea
mewiella (Rayment, 1944) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
mimica (Rayment, 1944) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
murrayensis (Rayment, 1935, 1939) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
murrayi (Rayment, 1944) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
parapulchra (Rayment, 1947b) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
perasserta (Rayment, 1947b) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
perpulchra (Rayment, 1947b) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
pulchra (Smith, 1854) (*Anthophora*) n. comb. (B.M.) (incorrectly attributed to our area according to Lieftinck, *in litt.*)
salteri (Cockerell, 1905j) (*Anthophora*) (B.M.)
sapiens (Cockerell, 1911b) (*Anthophora*) n. comb. (B.M.) Solomon Islands
shafferyella (Rayment, 1947b) (*Anthophora*) n. comb. (desc.)
subsalteri (Rayment, 1947b) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
sybilae (Rayment, 1944) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
thorogoodi (Rayment, 1939) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
tinsleyella (Rayment, 1944) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
townleyella (Rayment, 1947b) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
walkeri (Cockerell, 1905j) (*Anthophora*) (B.M.)
wallacei (Cockerell, 1907a) (*Anthophora*) n. comb. (desc.) Ambon
wallaciella (Rayment, 1947b) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
whiteleyella (Rayment, 1947b) (*Anthophora*) n. comb. (desc. C.S.I.R.O.*)
zonata (Linnaeus, 1758) (*Apis*) reported from Australia and Indies

Megilla fulvata Fabricius (1804) has been placed in this group (Dalla Torre, 1896) but is a *Nomia*.

SUBGENUS ASAROPODA COCKERELL

Text figures 760, 765

Asaropoda COCKERELL, 1926b, p. 216. Type: *Saropoda bombiformis* Smith, 1854 (original designation).

This subgenus contains species without blue or white metasomal bands and without any blue or green pubescence. Most of the species are larger than those of *Amegilla*, *sensu stricto*, and some (e.g., *dawsoni*) reach a length of nearly 20 mm.

This group has usually been given generic rank for the sole reason that its species are said to lack the last two segments of the labial palpi. However, many specimens of the type species as well as other species possess these segments, just as does *Amegilla*. It is not clear to me whether any lack of these segments occurs in life; perhaps they are easily broken off. In spite of the complete failure of this character, other group characters do exist, as indicated in the key.

A few records of nests of *Asaropoda* are given by Rayment (1951c). The following notes on *A. (A.) dawsoni* are available through the courtesy of Mr. G. F. Gross of the South Australian Museum, who forwarded to me a letter from Mr. Gaynor Owen-Smyth of Oolooloo, South Australia. Mr. Owen-Smyth observed these enormous bees on William-bury Station, which is situated 160 miles northeast of Carnarvon, Western Australia. He saw large numbers of the bees going in and out of holes in a flat claypan area. Over the holes were turrets 2 to 2½ inches high and ⅝ inch in diameter. The bees were very noisy and fast flying. Males were attracted to holes without turrets (possibly emergence holes of young females) and were seen mating with females on the ground in the nesting area.

Mr. Owen-Smyth goes on to say that the aborigines call the bees *bandi* and dig up the larvae for food at certain seasons.

DISTRIBUTION: Australia (all states), New Guinea (unknown from Tasmania).

INCLUDED SPECIES

- Amegilla (Asaropoda) albiceps* (Rayment, 1951c) (*Asaropoda*) n. comb. (desc. N.M.V.*)
albigenella Michener, new name for *Asaropoda albigena* Rayment, 1931, Jour. Roy. Soc. Western Australia, vol. 17, p. 182, not *Anthophora albigena* Lepeletier, 1841, now included in *Amegilla* (desc.)
alpha (Cockerell, 1904b) (*Saropoda*) n. comb.
anomala (Cockerell, 1929a) (*Asaropoda*) n. comb. (A.M.N.H.)
bombiformis (Smith, 1854) (*Saropoda*) n. comb. (B.M.)
calva (Rayment, 1935) (*Anthophora*) n. comb.

- (cotypes, C.S.I.R.O., labeled "Aus. Mus. Coll."*)
cygni (Rayment, 1931b) (*Anthophora*) n. comb. (W. Agric.)
dentata (Rayment, 1951c) (*Asaropoda*) n. comb. (desc. C.S.I.R.O.*)
dentiventris (Rayment, 1951c) (*Asaropoda*) n. comb. (desc. N.M.V.*)
dawsoni (Rayment, 1951c) (*Anthophora*) n. comb. (N.M.V.*)
flava (Friese, 1911a) (*Anthophora*) n. comb. (desc.)
froggatti (Cockerell, 1914i) (*Anthophora*) n. comb. (B.M.)
grisescens (Rayment, 1931b) (*Anthophora*) n. comb. (C.S.I.R.O.)
imitata (Rayment, 1951c) (*Asaropoda*) n. comb. (desc. C.S.I.R.O.*)
melionensis (Rayment, 1951c) (*Asaropoda*) n. comb. (desc. N.M.V.*)
preissi (Cockerell, 1910i) (*Anthophora*) n. comb. (Berlin*)
punctata (Rayment, 1931b) (*Asaropoda*) n. comb. (desc. C.S.I.R.O.*)
rhodoscymna (Cockerell, 1905j) (*Anthophora*) n. comb. (B.M.)
rickae (Rayment, 1951c) (*Asaropoda*) n. comb. (desc.)
rubricata (Rayment, 1951c) (*Asaropoda*) n. comb. (desc.)
rufa (Rayment, 1931b) (*Asaropoda*) n. comb. (desc. C.S.I.R.O.*)
rufescens (Friese, 1911a) (*Anthophora*) n. comb. (desc.)
scymna (Gribodo, 1893) (*Anthophora*) n. comb.
sordida (Rayment, 1931b) (*Anthophora*) n. comb. (C.S.I.R.O.)
sordidula (Rayment, 1931b) (*Anthophora*) n. comb. (W. Agric.)
victoriensis (Rayment, 1951c) (*Asaropoda*) n. comb. (desc. N.M.V.*)

TRIBE MELECTINI

This tribe, which occurs on all continents except South America, is represented in Australia only by the genus *Thyreus*. All the Melectini are parasitic and lack a pollen-collecting scopa. The most closely related non-parasitic bees are members of the tribe Anthophorini.

GENUS THYREUS PANZER

Text figure 761

- Thyreus* PANZER, 1806, p. 263. Type: *Nomada scutellaris* Fabricius, 1781 (monobasic).
Crocissa PANZER, 1806, p. 263. Type: *Nomada*

scutellaris Fabricius, 1781 (designation of Sandhouse, 1943, p. 541).

Crocisa JURINE, 1807, p. 239. Type: *Nomada scutellaris* Fabricius, 1781 (present designation).

The type of *Crocisa* Jurine, 1801, was designated by Morice and Durrant in 1915 (see Sandhouse, 1943), but the 1801 paper was invalidated by Opinion 135 of the International Commission on Zoological Nomenclature. Therefore the same type species is here designated for *Crocisa* as validly published by Jurine in 1807. The genus has been known as *Crocisa* until relatively recently, but since Sandhouse (1943), Liefstinck (1959), and others have used the name *Thyreus*, and since the matter is of interest only to specialists, it seems best to accept the change required by priority.

Bees of this genus are robust, with conspicuous patches of short, appressed, blue to white pubescence giving them a very striking appearance. They are parasites in the nests of species of *Amegilla*.

DISTRIBUTION: Europe to South Africa, east to China, Japan, Philippine Islands, Malaya, Indonesia, Moluccas, New Guinea, Solomon Islands, Australia south to Victoria and central Western Australia.

INCLUDED SPECIES

- Thyreus albifrons* (Rayment, 1931b) (*Crocisa*) (W.A.M.)
albopictus (Cockerell, 1910j) (*Crocisa*) (B.M.)
albovittatus (Friese, 1912b) (*Crocisa*) = *Crocisa albo-maculata* Smith, 1868a, not de Geer, 1778 (B.M.)
amboinensis (Radoszkowski, 1893a) (*Crocisa*) (desc. Berlin*) Ambon
aspasius Liefstinck, 1959 (desc. M.P.*) Halma-hera, Batjan, Obi, Ternate
australensis (Radoszkowski, 1893a) (*Crocisa*) (Berlin*)
beatissimus (Cockerell, 1907b) (*Crocisa*) (B.M.)
caeruleifrons (Kirby, 1883) (*Crocisa*) (B.M.)
 Recorded from Australia; described from Tanimbar
caeruleopunctatus (Blanchard, 1840) (*Crocisa*) (desc. M.P.*)
darwini (Cockerell, 1905b) (*Crocisa*) (B.M.)
emarginatus (Lepelletier, 1941) (*Crocisa*) New Ireland
frieseanus (Cockerell, 1906d) (*Crocisa*) = *Crocisa atra* Friese, 1905, not Jurine, 1807 (Z.M.B.*)
 New Guinea

gemmatus (Cockerell, 1911b) (*Crocisa*) (B.M.)
Solomon Islands
lamprosomus (Boisduval, 1835) (*Crocisa*)
lugubris (Smith, 1879) (*Crocisa*) (B.M.)
macleayi (Cockerell, 1907a) (*Crocisa*) (A.M.-
N.H.)
mocsaryi (Friese, 1909) (*Crocisa*) (H.N.M.*)
New Guinea
nanus (Friese, 1905a) (*Crocisa*) (Berlin*) Kai,
Buru
nigrescens (Friese, 1905a) (*Crocisa*) Banda
Islands, south of Seram
nitidulus (Fabricius, 1804) (*Melecta*) Incor-
rectly recorded from Ambon; actually from
Australia or New Guinea (see Lieftinck,
1951)
novaeollandiae (Lepeletier, 1841) (*Crocisa*)
(desc.) (Z.S.M.*) Erroneously recorded from
our area
omissus (Cockerell, 1919c) (*Crocisa*) (U.S.N.M.)
pleurinatorius (Meyer, 1921) (*Crocisa*) De-
scribed from Turkestan but actually Aus-
tralian; Lieftinck writes that he has seen the
type
pulchellus (Guérin-Méneville, 1835) (*Crocisa*)
New Ireland
quadrimaculatus (Radoszkowski, 1893a) (*Cro-*
cisa) (desc.)
quadrinotatus (Radoszkowski, 1893a) (*Crocisa*)
(desc.)
quartinae (Gribodo, 1884) (*Crocisa*) Celebes;
erroneously recorded from our area
radoszkowskyi (Dusmet y Alonso, 1915) (*Cro-*
cisa) Ambon
rotundatus (Friese, 1905a) (*Crocisa*) (Berlin*)
rufitarsus (Rayment, 1931b) (*Crocisa*) (W.
Agric.)
sicarius Lieftinck, 1962 (W.A.M.) = *albolateralis*
Lieftinck, 1962
tinctus (Cockerell, 1905b) (*Crocisa*) (B.M.)
turneri (Friese, 1905a) (*Crocisa*) (Berlin*)
(desc.)
verticalis (Cockerell, 1909b) (*Crocisa*) (B.M.)
Ambon
wallacei (Cockerell, 1905b) (*Crocisa*) (B.M.)
Philippine Islands; erroneously recorded from
Ternate
waroonensis (Cockerell, 1913c) (*Crocisa*) (B.M.)

Lieftinck (1959) gave an important review of the forms of the *nitidulus* group, and the same author (1962) reviewed the species of the Australian Region. Meyer (1921b) reviewed the species of the world. According to Lieftinck, there are only 10 species in our area, with *rufitarsus* and *quadrimaculatus* unrecognized and possibly additional species.

The rest of the names above listed are synonyms, subspecies, or errors. The following list shows the proper allocations of the various names:

caeruleopunctatus (Blanchard, 1840)
australensis (Radoszkowski, 1893a)
frieseanus (Cockerell, 1906d)
atra (Friese, 1905)
mocsaryi (Friese, 1909)
lugubris (Smith, 1879)
albopictus (Cockerell, 1910j)
turneri (Friese, 1905a)
macleayi (Cockerell, 1907a)
albomaculatus (Smith, 1868)
albovittatus (Friese, 1912b)
plurinatorius (Meyer, 1921)
nitidulus aspasius Lieftinck, 1959
nitidulus gemmatus (Cockerell, 1911b)
nitidulus nitidulus (Fabricius, 1804)
caeruleifrons (Kirby, 1883)
beatissimus (Cockerell, 1907b)
darwinii (Cockerell, 1905b)
lamprosomus (Boisduval, 1835)
omissus (Cockerell, 1919c)
nitidulus pulchellus (Guérin-Méneville, 1835)
emarginatus (Lepeletier, 1841)
nitidulus verticalis (Cockerell, 1909b)
radoszkowskyi (Dusmet y Alonso, 1915)
novaeollandiae amboinensis (Radoszkowski,
1893a)
nanus (Friese, 1905a)
nigrescens (Friese, 1905a)
quadrimaculatus (Radoszkowski, 1893a)
rotundatus (Friese, 1905a)
albifrons (Rayment, 1931b)
rufitarsus (Rayment, 1931b)
sicarius Lieftinck, 1962
tinctus (Cockerell, 1905b)
waroonensis (Cockerell, 1913c)

SUBFAMILY XYLOCOPINAE

This subfamily consists of two tribes that contain species very different in appearance, as indicated below.

KEY TO THE TRIBES OF THE XYLOCOPINAE

Stigma virtually absent; distal parts of wings strongly papillate; metanotum vertical; robust forms more than 14 mm. in length . . . Xylocopini
Stigma large; distal parts of wings not papillate; metanotum horizontal; slender forms less than 10 mm. in length . . . Ceratinini

TRIBE CERATININI

This tribe, which occurs on all continents, consists of small slender bees, at first sight so

different from the Xylocopini that their relationship is not at all evident. Reasons for believing them to be related were given by Michener (1944, 1953). Except for the genus *Ceratina*, all Australian species rear their larvae in groups rather than isolated, one per cell. In this respect these genera differ from all other bees except *Bombus*.

KEY TO THE GENERA OF CERATININI IN THE
AUSTRALIAN REGION

1. Three submarginal cells; marginal cell broadly rounded at apex; clypeus L-shaped, portion above tentorial pits little if any more than half as broad as lower portion . . . *Ceratina*
Two submarginal cells; marginal cell bluntly to acutely pointed on or near costa; clypeus above tentorial pits not greatly narrower than below 2
2. Second recurrent vein present; maxillary palpus six-segmented; male gonostylus large, reaching apex of penis valve which does not have retrorse bristles *Allodapula*
Second recurrent vein absent; maxillary palpus five-segmented; male gonostylus small, much exceeded by penis valve which bears coarse retrorse bristles on outer sides 3
3. Female with ordinary tibial scopa and tridentate mandible; face not noticeably concave; middle and hind tibial spurs slender, gently curved, in female half as long as basitarsi or longer; anterior margin of pronotum with an inconspicuous rounded angle at level of base of coxa . . . *Exoneura*
Female with scopa reduced to mass of short, dense hairs; mandible of female with ventral tooth reduced to mere convexity so that mandibles are bidentate; face strongly concave; middle and hind tibial spurs robust and in female strongly curved apically, less than half as long as basitarsi; anterior margin of pronotum in both sexes with a sharp angle or small spine at level of base of fore coxa *Inquilina*

GENUS *CERATINA* LATREILLE

Text figure 766

This is a genus of small bees having the aspect of *Allodape* and *Exoneura*, but immediately distinguishable by the possession of three submarginal cells. The species in Australia is greenish black, with limited pale facial marks. Nests are made in dead dry pithy stems. The cells are unlined, separated by partitions made of bits of pith. Larvae spin no cocoons. Details on the biology of

the Australian species were given by Michener (1962b).

KEY TO THE SUBGENERA OF *Ceratina* IN THE
AUSTRALIAN REGION

1. Subhorizontal surface of propodeum much less than one-third as long as vertical surface medially, the surfaces separated by sharp carina; preoccipital carina present; very coarsely punctate, metallic species, lower paraocular areas with very large, flat-bottomed punctures; basitibial area not indicated in any way; sixth sternum of male with lateral tooth *Pithitis*
Horizontal surface of propodeum more than one-third as long as sloping posterior surface, no carina separating them; preoccipital carina absent; relatively finely punctate, usually with impunctate areas on head and thorax; apex of basitibial area indicated by projecting spicule in female; sixth sternum of male without lateral tooth 2
2. Head about as long as broad; maxillary palpi (in ours) five-segmented; body black or greenish black, with yellow or white markings limited to lower paraocular areas (males), clypeus, and pronotal lobes *Ceratina, sensu stricto*
Head broader than long; maxillary palpi six-segmented; body black, with extensive yellow markings. *Ceratinidia*

SUBGENUS *CERATINA* LATREILLE, SENSU STRICTO

Text figure 766

Clavicera LATREILLE, 1802, p. 432. Type: *Hylaeus albilabris* Fabricius, 1793 = *Apis cucurbitina* Rossi, 1792 (monobasic).

Ceratina LATREILLE, 1802, p. 380 (new name for *Clavicera*). Type: *Hylaeus albilabris* Fabricius, 1793 = *Apis cucurbitina* Rossi, 1792 (autobasic).

Neoceratina PERKINS, 1912, p. 117. Type: *Neoceratina australensis* Perkins (monobasic).

Ceratinula MOURE, 1941, p. 78. Type: *Ceratina lucidula* Smith, 1854 (original designation).

In a previous publication (Michener, 1954), I commented on the proximity of *Ceratinula* of the Western Hemisphere to *Ceratina, sensu stricto*. Now, having studied more species from the Eastern Hemisphere, especially such forms as *bispinosa* Handlirsch and *dentipes* Friese, I see no way to separate *Ceratinula*, unless each species group is to receive a subgeneric name. It consists of small, smooth species, but some such occur in the Eastern Hemisphere as well, as in the Amer-

icas. *Neoceratina* was separated under the misapprehension that *Ceratina*, *sensu stricto*, has six-segmented maxillary palpi, but only some specimens of the type species have six-segmented palpi. As a rule species of this subgenus have only five segments. The rather attenuate and pointed or bidentate sixth tergum of the male is characteristic of a species group, to which both of our species belong, for which the name *Neoceratina* is available. This group ranges as far west as Asia Minor and Cyprus (*bispinosa*) and also occurs in Africa and north to Micronesia (*palauensis* Yasumatsu). At least in the present state of knowledge of the whole genus, I prefer to regard this as a species group rather than as a separable subgenus.

DISTRIBUTION: All continents; most abundant in the Neotropical Region, poorly represented in North America, Africa, and tropical Asia but occurs in India, Indonesia (Java), New Guinea, Solomon Islands, Queensland, and New South Wales.

INCLUDED SPECIES

Ceratina (*Ceratina*) *australensis* (Perkins, 1912) (*Neoceratina*) (B.M.)
bribiensis (Cockerell, 1914j) (*Allodape*) (Q.M.)
dentipes Friese, 1914 Java, Misool, New Guinea, Solomon Islands to Philippine Islands, and southeast Asia

There is only one Australian species (*bribiensis* = *australensis*). *Ceratina propinqua* Cameron from India is very like *australensis* and is perhaps the same species.

SUBGENUS CERATINIDIA COCKERELL AND PORTER

Ceratinidia COCKERELL AND PORTER, 1899, p. 406. Type: *Ceratina hieroglyphica* Smith, 1854 (monobasic and original designation).

This subgenus has six-segmented maxillary palpi and extensive yellow integumental markings on the black, nonmetallic body.

DISTRIBUTION: Ceylon, India, Malaya, Thailand, China, Philippine Islands, Taiwan, Indonesia, New Guinea.

INCLUDED SPECIES

Ceratina (*Ceratinidia*) *interrupta* Alfken, 1926 (desc.) Buru
papuana van der Vecht, 1952 (paratype U.S.N.M.) New Guinea

SUBGENUS PITHITIS KLUG

Pithitis KLUG, 1807, p. 198. Type: *Apis smaragdula* Fabricius, 1787 (monobasic).

This is the most distinctive of the subgenera of *Ceratina* and possibly deserves generic rank.

DISTRIBUTION: India, Malaya, China, Taiwan, Philippine Islands, Indonesia, east to Ambon. At least one species (*fastigata* Fox) reaches Africa, but the subgenus is predominantly Oriental.

INCLUDED SPECIES

Ceratina (*Pithitis*) *aurata* Friese, 1909 Celebes, Ambon [a subspecies of the wide-ranging *smaragdula* (Fabricius) according to van der Vecht]

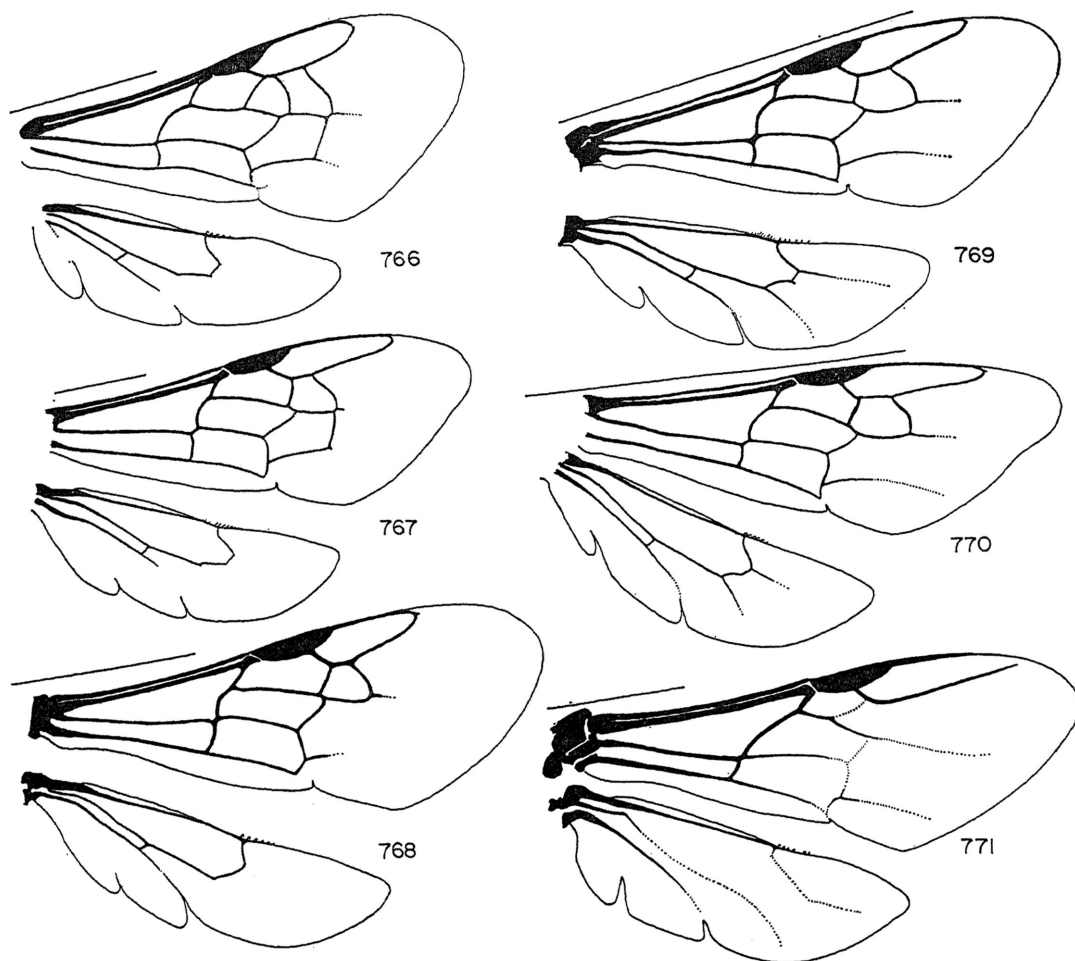
GENUS ALLODAPULA COCKERELL

Text figures 767, 772, 773

Allodapula COCKERELL, 1934b, pp. 220, 237. Type: *Allodape variegata* Smith, 1854 (original designation).

This genus consists of small, slender bees resembling *Ceratina*, or especially *Exoneura*, in shape. Ours are black, with yellow or white on the lower paraocular areas (some males only), clypeus, and posterior lobes of the pronotum; in many African species the metasoma is red. The genus differs from *Exoneura* in possessing the second recurrent vein and from *Ceratina* in having only two submarginal cells. From the African genus *Allodape* it differs in having a broader stigma, cleft claws of the usual sort (in *Allodape* the inner prongs are flattened and obliquely truncate), uniformly pubescent hind tibiae in the females (in females of *Allodape* the distal half of the outer side has an area of very dense hairs), and in being smaller.

In spite of the fact that they have been traditionally separated, the close relationship may be with *Exoneura* rather than *Allodape*. If one ignores the venational reduction of *Exoneura*, it is difficult to separate from *Allodapula*. In *Allodapula* (also *Allodape*) there is no basitibial plate in the female, except that in most Australian and some Asiatic species it is indicated by a carina posteriorly, rising to an apical point. The apical part of this carina is somewhat oblique, not transverse like the comparable



FIGS. 766-771. Wings of Xylocopinae (Ceratini) and Apinae. 766. *Ceratina* (*Ceratina*) *australensis*. 767. *Allodapula* *simillima*. 768. *Exoneura* (*Exoneurella*) *lawsoni*. 769, 770. *E.* (*Exoneura*) *bicolor*, female and male. 771. *Trigona* (*Plebeia*) *australis*. The scale lines represent 1 mm. except for *Exoneura bicolor* for which they represent 5 mm.

carina in *Exoneura*. In *Exoneura* a basitibial plate of similar size to that indicated in some *Allodapula* is more or less completely demarcated, or at least the highest part of the carina is transverse, across the apex of the plate. The maxillary palpi are six-segmented in *Allodapula*, five-segmented in *Exoneura*. In larval characters *Exoneura* differs strikingly from our *Allodapula*, for it has ventrolateral projections along the body and a more or less ordinary-shaped head, while our *Allodapula* as well as those from Asia lack such projections and have the head produced laterally and provided with very long curved hairs. African *Allodapula*, however, do

not agree with ours in these larval characters; perhaps they are generically or subgenerically distinct, but a fuller study of African species will be necessary to decide this point.

A key to Australian species and descriptions and figures of larvae were given by Michener and Syed (1962).

The biology of some Australian species was discussed by Michener (1963a). They nest in abandoned burrows of other insects in dead, dry twigs or stems. Immature stages of various ages are found together (not in separate cells) and are cared for, in many nests, by unfertilized, worker-like adult females. The young are fed progressively, not by mass pro-

visioning. Two species, *associata* and *prae-sumptiosa*, are probably parasitic in nests of other species.

The flight behavior of males was not described in the above-mentioned paper, but was observed by me at several places in and near Port Moresby, New Guinea, in April, 1959. Males, mostly of *A. nitida* but some of *A. plebeia*, began flying in swiftly zig-zag fashion around certain low masses of vegetation as early as 7:00 A.M. and continued such activity until the day became hot at about 10:00 A.M. After that males could be taken only in moderate numbers on flowers, but during the period of rapid, zig-zag (nuptial?) flight, many could be caught with a few sweeps of the net in certain places.

DISTRIBUTION: Africa, Ceylon, India, Mikoi (Indian Ocean), China, Malaya, Philippine Islands, Taiwan, Indonesia, New Guinea, Solomon Islands, Queensland, New South Wales, Northern Territory, Western Australia.

INCLUDED SPECIES

Allodapula associata Michener, 1961a (Q.M.)
biroi (Friese, 1909) (*Allodape*) (desc.) New Guinea
boharti Krombein, 1951, Solomon Islands
clarissima (Cockerell, 1929a) (*Allodape*) (U.S.N.M.)
diminuta (Cockerell, 1915a) (*Allodape*) (U.S.N.M.)
grisea (Alfken, 1907) (*Allodape*) (desc.)
minor Michener and Syed, 1962 (B.M.)
nitida (Smith, 1859b) (*Allodape*) (Ox.) Aru
occidentalis Michener and Syed, 1962 (W.A.M.)
perkinsiella Michener and Syed, 1962 (B.M.)
plebeia (Cockerell, 1929a) (*Allodape*) (U.S.N.M.)
praesumptiosa Michener, 1961a (B.M.)
simillima (Smith, 1854) (*Allodape*) (B.M.)
unicolor (Smith, 1854) (*Allodape*) (B.M.)

Examination of the types shows that *Allodape picta* Smith is in reality a *Euryglossa* and *A. bribiensis* Cockerell is a *Ceratina*. It seems very probable that *A. grisea* is not an *Allodapula*; probably it is a *Euryglossa*.

GENUS EXONEURA SMITH

Plate 15, figures 5-12; text figures 768-770, 774-781, 783, 784

This genus contains soft-bodied, slender bees, often with the metasoma red. Biological observations on *Exoneura* appeared in the

following publications: Erickson and Rayment (1951), Rayment (1935, 1946a, 1946c, 1946d, 1948a, 1949c, 1949d, 1951a, 1954c, 1956a), and Michener (1964b, 1965). A summary was given by Sakagami (1960). Larvae were described in a general way in the papers by Rayment and in more detail by Syed (1963) and Michener (1964b, 1965). The nests are similar to those of *Allodapula* but are usually excavated into pith by *Exoneura*. As in *Allodapula*, the larvae are fed progressively and live together, not in separate cells as in almost all other bees. They have peculiar projections, especially on the mesothorax, which may serve for holding the pollen mass. Except for the subgenus *Exoneurella*, slightly differentiated castes are often recognizable on dissection of females, even in nests containing only two or three mature females (Michener, 1965).

The genitalia of all subgenera are basically similar.

KEY TO THE SUBGENERA OF *Exoneura*

1. Vein Cu_1 usually long and gradually tapering; clypeus usually widely separated from antennal sockets so that subantennal sutures are about as long as diameter of socket; fore tarsus of male attenuate, first two segments taken together longer than tibia; hind basitarsus of male dilated (scarcely so in *asimillima*), nearly as wide as tibia (except in *asimillima*), not parallel sided
Exoneura, *sensu stricto*
2. Vein Cu_1 a short stub, ending abruptly, although in some cases continued as a pigmented line; clypeus usually closely approaching antennal sockets so that subantennal suture is much shorter than diameter of socket; fore tarsi of male of ordinary form, first two segments taken together shorter than or as long as tibia; hind basitarsus of male much more slender than tibia, parallel sided
Exoneurella
2. Costal margin of second submarginal cell short, often less than half as long as first transverse cubital vein; basitibial plate not indicated; sixth metasomal tergum of female with apex strongly produced, upturned, bidentate, not at all hidden by pubescence
Exoneurella
- Costal margin of second submarginal cell usually almost as long as first transverse cubital vein; basitibial plate of female indicated by a carina which is strongly raised across apex of plate; sixth metasomal tergum

of female with apex little produced, not or weakly upturned, not or minutely bidentate, and usually hidden by pubescence which is denser at apex of tergum than elsewhere . . .

. *Brevineura*

Exoneura NOT PLACED IN THE PRESENT
CLASSIFICATION

marjoriella Rayment, 1949c (desc.)

nigrescens Friese, 1899 (desc.)

SUBGENUS *EXONEURELLA* MICHENER

Plate 15, figures 4, 5; text figures 768, 774-779

Exoneurella MICHENER, 1963b, p. 257. Type: *Exoneura lawsoni* Rayment, 1946 (monobasic and original designation).

This subgenus, based on a single species, is similar in the adult to certain small, entirely black species of *Brevineura*. It differs from typical members of that subgenus in the characters listed in the key to subgenera. Unfortunately a few species of *Brevineura* are so similar in adult characters to *Exoneurella* that they can be distinguished only with much difficulty. Thus, *E. minutissima*, *rufitarsis*, *roddiana*, *normani*, and *nigrofulva* lack distinct basitibial plates in the female, and the first of these has the costal margin of the second submarginal cell short as in *Exoneurella*. In none of these species is the sixth metasomal tergum so produced as in *Exoneurella*, but it is slightly produced in some.

The main distinguishing features of *Exoneurella* are found in the larvae, which are utterly different from those of *Brevineura*. Larvae of *Exoneurella* have no ventrolateral projections or arms; instead the head has enormous, hairy, ventrolateral lobes. The antennae are also long, and the mouthparts are reduced. Larvae of *Brevineura*, like those of *Exoneura*, *sensu stricto*, have ventrolateral projections, those of the mesothorax very large and often branched, and have rather normal heads. Further distinguishing details were given by Syed (1963). It is true that larvae are not known for the species *minutissima*, *rufitarsis*, and *nigrofulva*, which have adults very like those of *Exoneurella*, but larvae were described by Rayment for *roddiana* and *normani* and are similar to those of other *Brevineura*. Unfortunately Rayment described *Brevineura* larvae also as being

those of *lawsoni*, the type species of *Exoneurella*, but there is evidence that his female and larva were not conspecific with the male, which he described in greater detail and which is the type of the species. The parallel inner orbits and lack of yellow at the bases of the tibiae are among the characters of the female attributed to *lawsoni* by Rayment which do not agree with my females of *lawsoni*.

A noteworthy biological character of *Exoneurella* is that it is solitary rather than social as are other *Exoneura*.

Although the larvae of *lawsoni* are so different from those of other known species of *Exoneura* that generic separation is indicated, the similarity of the adult *lawsoni* to some *Exoneura* (*Brevineura*) is so great that, at least until larvae of all such forms are known, it seems best to relegate *Exoneurella* to subgeneric status.

DISTRIBUTION: New South Wales, southern Queensland.

INCLUDED SPECIES

Exoneura (*Exoneurella*) *lawsoni* Rayment, 1946d

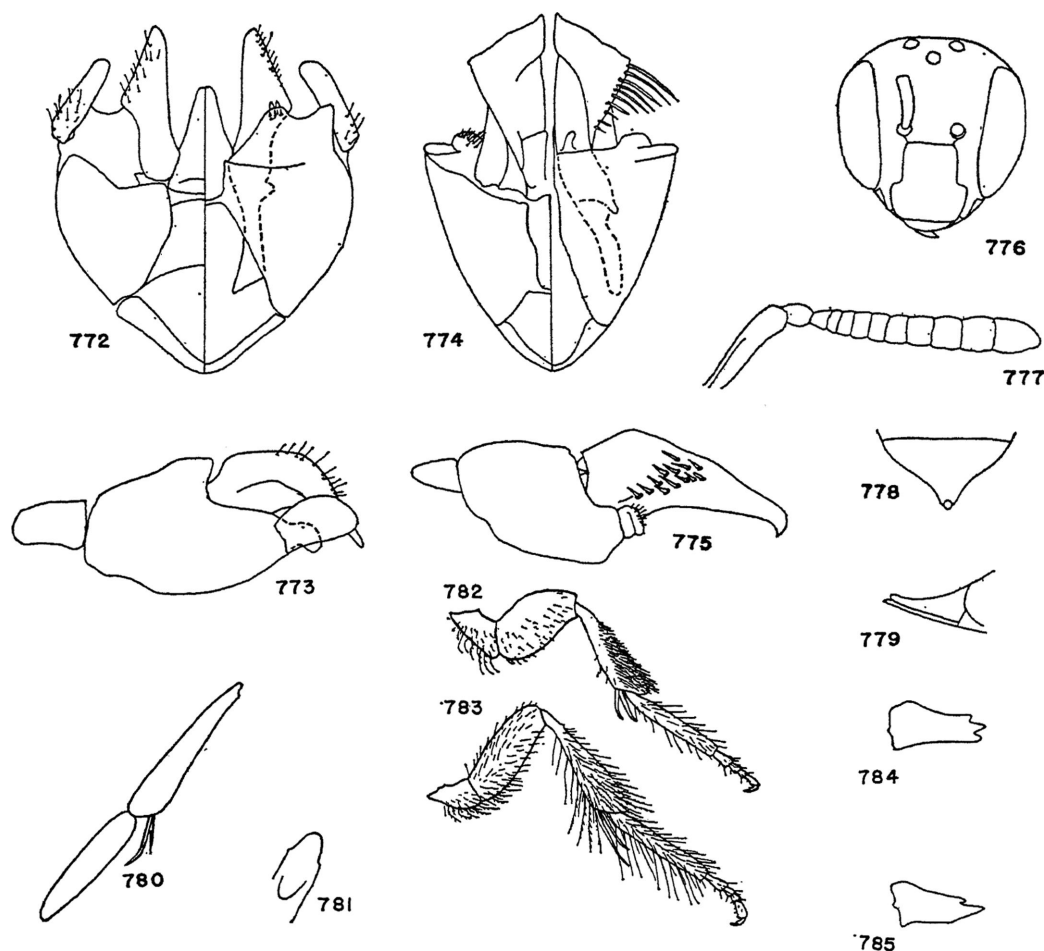
BREVINEURA, NEW SUBGENUS

Plate 15, figures 6, 7

TYPE: *Exoneura concinnula* Cockerell, 1913.

This subgenus differs from the typical subgenus in the characters listed in the key to subgenera. In general, its species are smaller than those of *Exoneura* proper, although *E. (Brevineura) tau*, *aterrima*, *subexcavata*, and others are as large as medium-sized species of *Exoneura* proper, and *E. elongata* is as large as large species of *Exoneura*, *sensu stricto*. Moreover, there are rather small species of the latter subgenus such as *E. (E.) illustris* and *albopilosa*.

Because of the very striking characters distinguishing this subgenus, especially in the males, it might reasonably be regarded as generically distinct, except for the existence of a few intergrading species. In *E. aterrima* the subantennal sutures are about as long as the diameter of the antennal sockets, although in other characters this species falls clearly in *Brevineura*. More confusing are *E. apposita*, *variabilis*, and perhaps others. These species are rather obviously related to such species of *Exoneura*, *sensu stricto*, as



FIGS. 772-785. Xylocopinae, Ceratinini. 772, 773. Dorsal-ventral and lateral views of male genitalia of *Allodapula unicolor*. 774, 775. Same of *Exoneura* (*Exoneurella*) *lawsoni*. 776, 777, 778, 779. Face, antenna, and dorsal and lateral views of apex of metasoma of *E. (E.) lawsoni*. 780. Tibia and basitarsus of male of *E. (Exoneura) bicolor*. 781. Base of tibia of female of *E. (E.) hackeri*, showing basitibial plate. 782, 783. Hind legs of females of *Inquilina excavata* and *Exoneura hackeri*. 784, 785. Mandibles of females of *Exoneura (Exoneura) hackeri* and *Inquilina excavata*.

richardsoni and *hackeri* and agree with that subgenus in the striking characters of the male tarsi. For this reason they have been included in *Exoneura*, *sensu stricto*, in spite of the facts that the subantennal sutures are in some cases shorter than the diameters of the antennal sockets, the head and thorax are only moderately hairy, the eyes are not enlarged, and in some individuals vein Cu_1 ends abruptly.

DISTRIBUTION: Victoria to southern Queensland.

INCLUDED SPECIES

- Exoneura (Brevineura) albolineata* Cockerell, 1929c (A.M.)
aterrima Cockerell, 1916d (U.S.N.M.)
botanica Cockerell, 1905e (B.M.)
brisbanensis Cockerell 1916d (U.S.N.M.)
clarissima Cockerell, 1915a (U.S.N.M.)
cliffordiella Rayment, 1953a (C.S.I.R.O.)
concinna Cockerell, 1913a (U.S.N.M.)
elongata Rayment, 1954c (C.S.I.R.O.)
froggatti Friese, 1899
gracilis Cockerell, 1918b (Q.M.)
maculata Rayment, 1935 (C.S.I.R.O.)

melaena Cockerell, 1918b (Q.M.)
minutissima Erickson and Rayment, 1951 (C.S.I.R.O.)
nigrofulva Rayment, 1935 (C.S.I.R.O.)
nitida Cockerell, 1922a (Q.M.)
normani Rayment, 1948a (C.S.I.R.O.)
parvula Rayment, 1935 (Wilson)
perparvula Rayment, 1948b (C.S.I.R.O.)
perplexa Rayment, 1953a (C.S.I.R.O.)
ploratula Cockerell, 1912b (U.S.N.M.)
roddiana Rayment, 1946d (C.S.I.R.O.)
rufitarsis Rayment, 1948b (C.S.I.R.O.)
simillima Rayment, 1935 (C.S.I.R.O.)
subexcavata Rayment, 1951a (C.S.I.R.O.)
tau Cockerell, 1905e (B.M.)
xanthochypeata Rayment, 1935 (C.S.I.R.O.)

SUBGENUS *EXONEURA* SMITH, SENSU STRICTO

Plate 15, figures 8-12; text figures 769, 770, 780, 781, 783, 784

Exoneura SMITH, 1854, p. 232. Type: *Exoneura bicolor* Smith, 1854 (monobasic).

The principal characters of the subgenus are given in the key to subgenera. *Exoneura*, sensu stricto, agrees with all characters listed for *Brevineura* in the second couplet of that key. In addition, males of most species are characterized by having numerous long hairs on the head and thorax and eyes much dilated. The approach toward *Brevineura* on the part of certain species is discussed under that subgenus.

The larvae are similar to those of *Brevineura* and very different from those of *Exoneurella* (see Syed, 1963).

DISTRIBUTION: Tasmania, Australia north to southern Queensland.

INCLUDED SPECIES

Exoneura (*Exoneura*) *abstrusa* Cockerell, 1922a (Q.M.)
albopilosa Erickson and Rayment, 1951 (C.S.I.R.O.)
angophorae Cockerell, 1912b (U.S.N.M.)
angophorella Rayment, 1948a (C.S.I.R.O.)
apposita Rayment, 1949c (C.S.I.R.O.)
asimillima Rayment, 1951a = *simillima* Rayment, 1949d, not 1935
baculifera Cockerell, 1922 (Q.M.)
baxteri Rayment, 1956a (C.S.I.R.O.)
bicincta Rayment, 1935 (desc. N.M.V.)
bicolor Smith, 1854 (B.M.)
diversipes Cockerell, 1922a (Q.M.)
florentiae Rayment, 1939 (C.S.I.R.O.)
fultoni Cockerell, 1913a (U.S.N.M.)

grandis Rayment, 1935 (C.S.I.R.O.)
hackeri Cockerell, 1913a (Q.M.) (allotype = *tau*)
hamulata Cockerell, 1905e (B.M.)
holmesi Rayment, 1946c (C.S.I.R.O.)
illustris Erickson and Rayment, 1951 (C.S.I.R.O.)
incerta Cockerell, 1918b (Q.M.)
insularis Cockerell, 1914j (U.S.N.M.)
laeta Alfken, 1907 (desc.)
montana Rayment, 1939 (C.S.I.R.O.)
nigrihirta Rayment, 1953a (C.S.I.R.O.)
obliterata Cockerell, 1913a (U.S.N.M.)
obscura Alfken, 1907 (cotype W.A.M.)
obscuripes Michener, 1963b (C.S.I.R.O.)
occidentalis Cockerell, 1914j (B.M.)
perpensa Cockerell, 1922a (Q.M.)
pictifrons Alfken, 1907 (cotype W.A.M.)
punctata Rayment, 1930a (C.S.I.R.O.)
rhodoptera Cockerell, 1922a (Q.M.)
richardsoni Rayment, 1951a (C.S.I.R.O.)
robusta Cockerell, 1922a (Q.M.)
rufa Rayment, 1935 (C.S.I.R.O.)
subbaculifera Rayment, 1948a (C.S.I.R.O.)
subhamulata Rayment, 1935 (C.S.I.R.O.)
tasmanica Cockerell, 1930b (U.S.N.M.)
turneri Cockerell, 1914j (B.M.)
variabilis Rayment, 1949c (C.S.I.R.O.)
ziegleri Rayment, 1935 (C.S.I.R.O.)

GENUS *INQUILINA* MICHENER

Text figures 782, 785

Inquilina MICHENER, 1961d, p. 179. Type: *Exoneura excavata* Cockerell, 1922 (monobasic and original designation).

This genus is a derivative of *Exoneura*, sensu stricto, in which the pollen-collecting scopa has been lost. *Inquilina excavata* lives in the nests of *Exoneura variabilis*. An account of its biology was given by Michener (1965).

DISTRIBUTION: Victoria to southern Queensland.

INCLUDED SPECIES

Inquilina angulata (Rayment, 1951a) n. comb. (C.S.I.R.O.)
concava (Rayment, 1949c) n. comb. (C.S.I.R.O.)
dawsoni (Rayment, 1946a) n. comb. (C.S.I.R.O.)
excavata (Cockerell, 1922a) (Q.M.)

TRIBE *XYLOCOPINI*

This tribe consists of large, robust, fast-flying bees. It contains three genera, the strictly Australian *Lestis*, the genus *Proxycopa* of arid parts of Asia and southeastern Europe, and the widespread *Xylocopa* which

ranges into the northern half of Australia. The most distinctive features of the tribe are indicated in the key.

The following key contains certain features that apply to the Australian subgenus of *Xylocopa* but not to *Xylocopa* as a whole; these features are preceded by asterisks.

KEY TO THE GENERA OF THE XYLOCOPINI OF
THE AUSTRALIAN REGION

Maxillary palpi four-segmented; first transverse cubital vein nearly straight (in some cases incomplete), second submarginal cell less than twice as wide on posterior side as on anterior side; scutellum rounded posteriorly, not overhanging metanotum; angle between anterior and dorsal surfaces of first metasomal tergum rounded; basitibial plate of female represented by bare area margined with carinae in middle third of tibia and ending in two projecting scales, of male represented by scale beyond middle of tibia; apex of hind tibia of female bare, with strong, carinate, apical spine; posterior claws of female with basal teeth reduced to obtuse angles; male with interocular distance much less than width of eye, least at middle of clypeus, clypeus with impunctate, shining, elongate, ovoid convexity extending from lower to upper margin *Lestis*
Maxillary palpi six-segmented (in ours); first transverse cubital vein curved posterobasally (in some incomplete or lacking) so that second submarginal cell, when distinct, is more than twice as wide on posterior side as on anterior side; *scutellum ending posteriorly in sharp transverse carina overhanging metanotum;

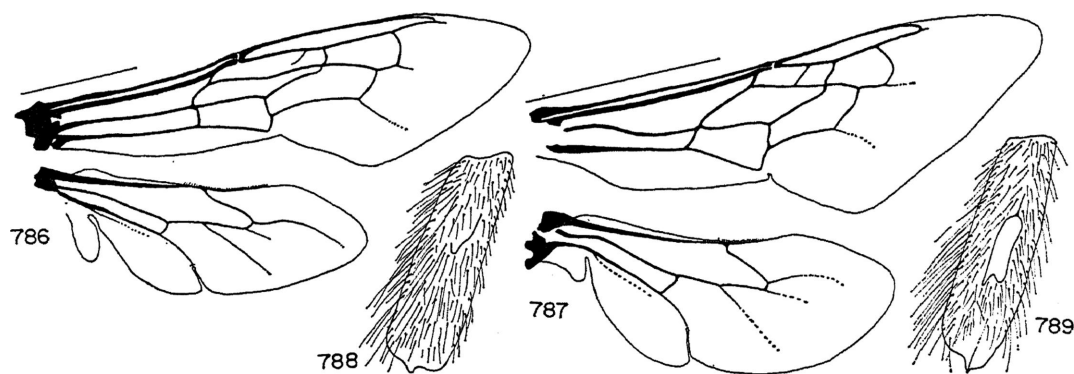
*angle between anterior and dorsal surfaces of first metasomal tergum about 90 degrees and only narrowly rounded; *basitibial plate of female represented by scale not or scarcely reaching middle of tibia, of male by scale before middle of tibia; *hind tibia of female with apical spine rather small, not carinate; *posterior claws of female with basal teeth large, like those on other legs; *male with interocular distance greater than width of eye, clypeus without large impunctate convex area. *Xylocopa*

GENUS *LESTIS* LEPELETIER AND SERVILLE

Text figures 787, 789

Lestis LEPELETIER AND SERVILLE, 1828, pp. 795, 799. Type: *Apis bombylans* Fabricius, 1779 (designation by Taschenberg, 1883, p. 82; see also Hurd and Michener, 1961).

The original type designation of *Apis muscaria* Fabricius, 1775, was based on a misidentification of Australian material by Lepeletier and Serville and raises a nomenclatural problem because the true *muscaria* has been found by Padre J. S. Moure to be a South American *Xylocopa* (see Hurd, 1959). If this designation were upheld, the name *Lestis* would have to be transferred from its presently accepted usage to the American group of *Xylocopa* currently known as *Schonherria*. Hurd and Michener (1961) have therefore requested that the original type designation be set aside and that *bombylans* be considered as the type.



FIGS. 786-789. Xylocopinae, Xylocopini. 786, 787. Wings of *Xylocopa* (*Koptortosoma*) *aruana* and *Lestis aeratus* (scale lines represent 5 mm.). 788, 789. Outer views of hind tibiae of females of *Xylocopa* (*Koptortosoma*) *aruana* and *Lestis aeratus*.

Lestis consists of brilliantly metallic carpenter bees, somewhat smaller than most *Xylocopa* but of the same form.

DISTRIBUTION: Northern Queensland to Victoria.

INCLUDED SPECIES

- Lestis aeratus* Smith, 1851 (Ox.)
australensis (Kirby, 1819) (*Xylocopa*) (desc.)
bombiliformis Froggatt, 1895 (*lapsus* for *bombylans*)
bombylans (Fabricius, 1775) (*Apis*) (B.M.)
gibbonsi Cockerell, 1929c (A.M.)
violacea Rayment, 1939 (*nomen nudum*, probably a *lapsus* for *violascens*)
violascens Cockerell, 1905a (desc.)

Nests are reported in wood of various kinds, including the erect dead stems of *Xanthorrhoea*. (Hurd and Moure, 1963, listed nesting situations and references.) Hacker (1918) gave good illustrations. There are probably only two valid species.

GENUS XYLOCOPA LATREILLE

Text figures 786, 788

Xylocopa LATREILLE, 1802, p. 431. Type: *Apis violacea* Linnaeus, 1758 (designation of Latreille, 1810, p. 439).

Xylocopa LATREILLE, 1802, p. 379 (consistently accepted emendation of *Xylocopa*).

This genus contains the very large robust carpenter bees found in all continents. The genus is particularly diversified in the Old World tropics, and at least six subgenera occur in Java, but only one reaches our area. Hurd and Moure (1963) have given a subgeneric revision.

Xylocopa (*Platynopoda*) *perforator* Smith (1862b) was described in error from Ternate; Lieftinck (1956) showed that it was really from Timor, but he also (1955) gave a perhaps doubtful record from Batjan. Maa's (1940) record of *X. (P.) latipes* from Ambon is also probably an error. *Xylocopa* (*Cyaneoderes*) *caerulea* (Fabricius) was described, obviously in error, from New Caledonia, as mentioned by Cockerell (1911b). Lieftinck (1956, 1957b) has reviewed the species of our area.

Bees of this genus nest in dead, dry wood, either sound or somewhat softened by decomposition. Rayment (1935) figured a nest of *aruana* in a small *Eucalyptus* stem, but I

have seen the same species nesting in fence posts. Lieftinck (1964) recorded the nest of *X. lindqvisti* in a branch. Hurd and Moure (1963) listed references to nesting places for each subgenus.

SUBGENUS KOPTORTOSOMA GRIBODO

Text figures 786, 788

Koptortosoma GRIBODO, 1894, p. 271. Type: *Apis aestuans* Linnaeus, 1758 (designation of Vitzthum, 1930, p. 315). Pseudotype: *Koptortosoma gabonica* Gribodo, 1894 (designation of Sandhouse, 1943, p. 561). *Koptortosoma* was emended unnecessarily to *Koptorthosoma* by Dalla Torre (1896) and *Coptorthosoma* by Pérez (1901).

Orbitella MAA, 1938 (not Douville, 1915), p. 270. Type: *Xylocopa confusa* Pérez, 1901 (original designation).

Maiella MICHENER, 1942, p. 282 (new name for *Orbitella* Maa). Type: *Xylocopa confusa* Pérez, 1901 (autobasic).

Euryapis SANDHOUSE, 1943, p. 551 (new name for *Orbitella* Maa). Type: *Xylocopa confusa* Pérez, 1901 (autobasic).

DISTRIBUTION: Africa; Arabia and Iran to southeast Asia, the Philippine Islands, Indonesia, New Guinea, Bismarck Archipelago, Australia south to New South Wales and central Western Australia.

INCLUDED SPECIES

- Xylocopa* (*Koptortosoma*) *aestuans* (Linnaeus, 1758) (*Apis*) (desc.) Asia, Indonesia. Erroneously recorded from Aru
adumbrata Lieftinck, 1957b (desc. M.L.*) New Guinea
aruana Ritsema, 1876 (M.L.*) Aru, New Guinea, Australia
bryorum (Fabricius, 1775) (*Apis*) (B.M.). Incorrectly attributed to our area; see Lieftinck, 1957a
buruana Lieftinck, 1956 (desc. M.L.*) Buru
ceramensis Cockerell, 1916 (desc.) Seram
combinata Ritsema, 1876 (desc. M.L.*) Obi
coronata Smith, 1861 (Ox.) Kaijoa, near Batjan
dalbertsi Lieftinck, 1957b (M.L.*) New Guinea
dimidiata Lepeletier, 1841 (desc.) Timor. Erroneously recorded from Australia
disconota Friese, 1914 (desc. Berlin*)
eunota Pérez, 1901 (desc.) Aru
finschiana Friese, 1914 (desc. Berlin*) New Britain
flavocinerea Alfken, 1926 (desc.) Seram
gressitti Lieftinck, 1957b (desc. W.*) New Britain

guigliae Liefstinck, 1957b (desc. M.C.G.*) New Guinea, Goodenough Island
hertlei Friese, 1914 (desc. Berlin*) New Guinea
karnyi Maidl, 1924 (W.*) New Guinea
lundqvisti Liefstinck, 1957b (desc. M.L.*) New Guinea
muiri Cockerell, 1939 (desc. paratype U.S.N.M.*) Ambon, Seram
mohnikei Cockerell, 1907a (desc.) Ambon
morotaiana Liefstinck, 1956 (desc. M.L.*) Morotai
nigroclypeata Rayment, 1935 (C.S.I.R.O.*)
nigroplagiata Ritsema, 1876 (desc. M.L.*) Aru
nobilis Smith, 1859a Celebes, ?Ambon (probably does not occur in our area)
parvula Rayment, 1935 (C.S.I.R.O.*)
perkinsi Cameron, 1901 (desc.) New Britain
provida Smith 1863 (Ox.) Misool, Waigeo
pseudocoronata Maidl, 1924 (desc.). Tanimbar, incorrectly recorded from New Guinea
rutilans Liefstinck, 1957b (desc. M.L.*) New Guinea
tumorifera Liefstinck, 1957b (desc. M.L.*) New Guinea
unicolor Smith, 1861 (Ox.*) Ambon
velutina Liefstinck, 1957b (M.L.*) New Guinea
wallabia Liefstinck, 1957b (desc. M.A.*)
xerophila Liefstinck, 1957b (desc. C.S.I.R.O.*)

Xylocopa muscaria (Fabricius, 1775) and *simillima* Smith, 1854, attributed to Australia, are American species. The common species in Australia has long been called *X. bryorum* but its correct name is *aruana*, as shown by Liefstinck (1957a). Liefstinck (1956, 1957b) has shown that, of the above list, the following are synonyms of other species: *ceramensis*, *flavocineria*, *muiri*, *pseudocoronata*, *finschiana*, *eunota*, and *hertlei*.

FAMILY APIDAE

This family contains all the highly social bees—honeybees, stingless honeybees, and bumblebees—as well as the tropical American Euglossini. Only in this family is pollen carried in a corbicula.

KEY TO THE SUBFAMILIES OF THE APIDAE

Hind tibial spurs present; large, robust bees. . . Bombinae
 Hind tibial spurs absent; small and moderate-sized bees . . . Apinae

SUBFAMILY BOMBINAE

This subfamily contains two tribes, the Bombini and the Neotropical Euglossini. The

Bombinae are not native in our area but are included because of introduced species.

The tribe Bombini in our area includes only the genus *Bombus*. The only other genus, *Psithyrus*, consists of social parasites found in the nests of *Bombus* in the Holarctic Region.

GENUS BOMBUS LATREILLE

Bombus LATREILLE, 1802, p. 437. Type: *Apis terrestris* Linnaeus, 1758 (monobasic).

A long list of synonymous or subgeneric names was given by Michener (1944). Subgeneric placement of our species is ignored below.

This genus contains the large, robust, hairy, black-and-red, black-and-white, or black-and-yellow bumblebees. Females can easily be recognized by the combination of corbiculae on the hind tibiae and hind tibial spurs.

DISTRIBUTION: North and South America, Eurasia, Japan, mountainous areas in Taiwan, the Philippine Islands, and Indonesia, east to Java. Unsuccessful attempts have been made to introduce British species into Australia, but they have been successfully introduced into New Zealand where they are of importance as pollinators.

INCLUDED SPECIES

According to Gurr (1957), of the various *Bombus* introduced into New Zealand, only the following are established:

Bombus hortorum (Linnaeus, 1761) (*Apis*) Europe, introduced in New Zealand
runderatus (Fabricius, 1775) (*Apis*) Europe, introduced in New Zealand
subterraneus latreillellus (Kirby, 1802) (*Apis*) Europe, introduced in New Zealand
terrestris (Linnaeus, 1758) (*Apis*) Europe, introduced in New Zealand

No attempt is made here to list the synonyms of the above species.

Biological data on bumblebees in New Zealand have been published by Cumber (1953, 1954).

SUBFAMILY APINAE

This subfamily contains the true honeybees and the stingless honeybees. Two tribes exist, separable as shown in the key.

KEY TO THE TRIBES OF THE APINAE

Apex of marginal cell open; veins forming sub-marginal cells weak or absent; sting not functional, never exerted Meliponini
 Apex of marginal cell closed; veins forming sub-marginal cells strong; sting of females functional Apini

TRIBE MELIPONINI

In our area this tribe includes only the genus *Trigona*, although a few other genera exist in the Neotropical and African areas.

GENUS TRIGONA JURINE

Text figure 771

Trigona JURINE, 1807, p. 245. Type: *Apis amalthea* Olivier, 1789 (designation of Latreille, 1810, p. 439).

This genus consists of small, dark, tropical or subtropical, stingless honeybees which live in large colonies; only the workers are commonly collected on flowers. The reduced wing venation is very distinctive. In our area, these are the only bees other than the introduced *Apis* and *Bombus* that have corbiculae.

Observations on the biology of species of our area were published by Michener (1961c); his paper listed previous contributions.

Only two subgenera of *Trigona* occur in our area, but numerous others are found elsewhere in the tropics.

KEY TO THE SUBGENERA OF *Trigona* OF THE AUSTRALIAN REGION

Inner surface of hind tibia with longitudinal, minutely setose elevated area, margined on each side by shining, largely bare, sloping or depressed areas, shining depressed area posterior to elevated area about as broad as latter; hind basitarsus usually with differentiated sericeous area on inner side basally; scutellum (in ours) black, produced posteriorly, overhanging metanotum, and reaching as far back as posterior part of propodeum *Tetragona*
 Inner surface of hind tibia largely elevated and minutely setose; shining depressed area posterior to elevated area merely a narrow rim; hind basitarsus uniformly hirsute on inner surface; scutellum (in ours) with pale markings, not much overhanging metanotum, and not reaching so far back as posterior part of propodeum *Plebeia*

SUBGENUS PLEBEIA SCHWARZ

Text figure 771

Plebeia SCHWARZ, 1938, p. 480. Type: *Trigona mosquito* Smith, 1863 (original designation).

Schwarziana MOURE, 1943, p. 147. Type: *Melipona quadripunctata* Lepeletier, 1836 (monobasic and original designation).

Friesella MOURE, 1946b, p. 611. Redescribed as new, Moure, 1946a, p. 441. Type: *Trigona schrottkyi* Friese, 1910 (monobasic and original designation).

Mourella SCHWARZ, in Moure, 1946a, p. 442. Type: *Melipona caerulea* Friese, 1900 (monobasic and original designation).

Austroplebeia MOURE, 1961, p. 195. Type: *Trigona cassiae* Cockerell, 1910 (original designation). New synonymy.

Plebeilla MOURE, 1961, p. 226. Type: *Trigona lendliana* Friese, 1900 (original designation and monobasic). New synonymy.

Plebeina MOURE, 1961, p. 228. Type: *Trigona denoiti* Vachal, 1903 (original designation). New synonymy.

DISTRIBUTION: Tropical America, Africa, New Guinea, northern Australia south to southern Queensland and northern Western Australia. The absence of this subgenus from tropical Asia and Indonesia is remarkable.

The name *Austroplebeia* Moure (1961) is available for anyone wishing to give generic or subgeneric rank to forms of our area. My opinion, based partly on the work of Wille (MS), is that these forms do not warrant even subgeneric status.

INCLUDED SPECIES

Trigona (Plebeia) australis Friese, 1898a
cassiae Cockerell, 1910a (B.M.)
cincta Mocsáry, 1898 (in Friese, 1898a) New Guinea
cockerelli Rayment, 1930b
essingtoni Cockerell, 1905b (B.M.)
ornata Rayment, 1932, published again as new in 1935 (N.M.V.)
percincta Cockerell, 1929c
symei Rayment, 1932, published again as new in 1935 (desc.)
websteri Cockerell, 1932 (cotype W. Agric.)

SUBGENUS TETRAGONA LEPELETIER AND SERVILLE

Tetragona LEPELETIER AND SERVILLE, 1828, p. 710. Type: *Trigona elongata* Lepeletier and

Serville, 1828 = *Centris clavipes* Fabricius, 1804 (original designation).

Frieseomelitta IHERING, 1912, p. 5. Type: *Trigona silvestrii* Friese, 1912 (monobasic and original designation).

Heterotrigona SCHWARZ, 1939, p. 96. Type: *Trigona itama* Cockerell, 1918 (original designation).

Geotrigona MOURE, 1943, p. 146. Type: *Trigona mombuca* Smith, 1863 (original designation).

Duckeola MOURE, 1944, p. 71. Type: *Trigona huberi* Friese, 1900 (monobasic and original designation).

Tetragonisca MOURE, 1946a, p. 438. Type: *Trigona jaty* Smith, 1863 (original designation).

Ptilotrigona MOURE, 1951, p. 47. Type: *Trigona heideri* Friese, 1900 (monobasic and original designation).

Homotrigona MOURE, 1961, p. 200. Type: *Trigona fimbriata* Smith, 1857 (original designation). New synonymy.

Platytrigona MOURE, 1961, p. 203. Type: *Trigona planifrons* Smith, 1864 (original designation). New synonymy.

Lophotrigona MOURE, 1961, p. 205. Type: *Trigona canifrons* Smith, 1857 (original designation). New synonymy.

Tetragonula MOURE, 1961, p. 206. Type: *Trigona iridipennis* Smith, 1857 (original designation). New synonymy.

Tetragonilla MOURE, 1961, p. 210. Type: *Trigona atripes* Smith, 1857 (original designation). New synonymy.

Geniotrigona MOURE, 1961, p. 212. Type: *Trigona thoracica* Smith, 1857 (original designation). New synonymy.

Odontotrigona MOURE, 1961, p. 213. Type: *Trigona haematoptera* Cockerell, 1919 (original designation). New synonymy.

Tetrigona MOURE, 1961, p. 215. Type: *Trigona apicalis* Smith, 1857 (original designation). New synonymy.

The names *Platytrigona*, *Lophotrigona*, and *Tetragonula* are applicable to species listed below, but I am in agreement with Wille (MS) that no such generic (or subgeneric) names are needed or desirable.

DISTRIBUTION: Tropical America, tropical Asia, the Philippine Islands, the Palau and Caroline islands east as far as Truk, Indonesia, New Guinea, Bismarck Archipelago, Solomon Islands, and Australia south as far as New South Wales and northern Western Australia. The absence of this subgenus from Africa is noteworthy.

INCLUDED SPECIES

Trigona (*Tetragona*) *angophorae* Cockerell, 1912b (B.M.)

atrata (Fabricius, 1798) (*Apis*) (desc.) Ambon

atricornis Smith, 1864 (Ox.) New Guinea

biroi Friese, 1898a New Guinea

canifrons Smith, 1857 (B.M.) Borneo, incorrectly attributed to Australia

carbonaria Smith, 1854 (B.M.)

clypearis Friese, 1908 New Guinea

flaviventris Friese, 1908 (desc.) New Guinea

genalis Friese, 1908 New Guinea

hockingsi Cockerell, 1929d (Q.M.)

iridipennis Smith, 1854 (B.M.) Ceylon to Solomon Islands

keyensis Friese, 1901 = *latigena* Friese, 1901 (desc.) Kai

laeviceps Smith, 1857 (B.M.) Singapore, reported from New Guinea and Australia

lamingtonia Cockerell, 1929c (A.M.) New Guinea

mellipes Friese, 1898a (desc.)

planifrons Smith, 1864 (B.M.) New Guinea

sapiens Cockerell, 1911b Solomon Islands

wybenica Cockerell, 1929a, 1929d (U.S.N.M.)

TRIBE APINI

This tribe includes only the genus *Apis* (true honeybees). Maa (1953) has recognized three genera and one subgenus, but the differences do not seem to warrant such splitting.

GENUS APIS LINNAEUS

In addition to the subgenus listed below, there are two other subgenera, *Megapis* and *Micrapis*, which are restricted to southern Asia, the Philippine Islands, and Indonesia, but probably do not reach our area. Maa (1953) characterized these subgenera (at the generic level) and listed *A. (Megapis) dorsata* Fabricius from Kai (p. 569) without other details. The species undoubtedly reaches Timor and possibly enters our area on Kai.

SUBGENUS APIS LINNAEUS

Apis LINNAEUS, 1758, pp. 343, 574. Type: *Apis mellifica* Linnaeus, 1761 = *A. mellifera* Linnaeus, 1758, designation of Latreille, 1810, p. 439.

Apicula RAFINESQUE, 1814, p. 29 (unnecessary replacement for *Apis* Linnaeus; type automatically the same as for *Apis*).

Apiarus RAFINESQUE, 1815, p. 123 (unnecessary

replacement for *Apis* Linnaeus; type automatically the same as for *Apis*).

Sigmatapis MAA, 1953, p. 556. Type: *Apis cerana* Fabricius, by original designation.

Species of this group are so familiar that they scarcely need description. The lack of hind tibial spurs and the tibial corbiculae of workers are shared only with *Trigona* in our fauna. The large size, complete wing venation, presence of a strong sting, and the hairy eyes distinguish *Apis* immediately from *Trigona*.

DISTRIBUTION: Native of Africa and Eurasia, including Japan, Taiwan, the Philippine Islands, and Indonesia, but not reaching our area. Now introduced into all parts of the world.

INCLUDED SPECIES

Apis (Apis) javana Enderlein, 1906 (desc.) South-

east Asia, Indonesia, not native in our area but introduced in the south Moluccan islands of Ambon and Saparua (Maa, 1953, p. 579). Smith (1826b) recorded *socialis* Latreille from Ternate but probably in error
mellifera Linnaeus, 1758 Africa, Eurasia, introduced into all parts of the world

No attempt has been made to list synonyms of *mellifera* or the various subspecies that have been introduced into Australia. The reader is referred to Dalla Torre (1896) and Maa (1953). Information on the spread of the honeybee in New Guinea has been given by Michener (1963d, 1963e).

Apis aenigmatica Rayment (1935), supposedly from southeastern Australia, is based largely on hearsay and must be a result of errors in observation, understanding, or memory.

APPENDIX 1. FLOWER RECORDS AND OTHER COLLECTING DATA

THE FOLLOWING LIST records numerous species of bees collected on flowers by me, mostly in southern Queensland, but to some extent in central Queensland and the New England area of New South Wales. The species are arranged in the same order as in the systematic section. Some common species were omitted because they appear to be undescribed. Identifications were made largely on the basis of material identified by Cockerell and preserved in the Queensland Museum. Of course the list is anything but exhaustive for the area, but because of the few proper flower records, with evidence of pollen collecting, and because of the need to provide concrete data to support the section on flower relationships, it appears to be worth publishing.

In the list that follows, flowers from which pollen was being collected are marked P., while those on which bees were particularly common are marked C. Lack of the letter P. indicates that the bees were males, or females that were not collecting pollen, except for the Hylaeinae and Euryglossinae in which pollen is not carried externally.

Leioproctus advena (Smith)

Brisbane, Qld., VIII-28-58, on *Leptospermum flavescens* P.; Dunwich, Stradbroke Is., Qld., VIII-20-58, on *Boronia rosmarinifolia*; Beerwah, Qld., VIII-29-58, on *Pultenaea villosa* P.; Beerwah, Qld., IX-10-58, on *Leptospermum flavescens*.

Leioproctus insularis (Cockerell)

Dunwich, Stradbroke Is., Qld., VIII-20-58, on *Hibbertia linearis* P.; Dunwich, Stradbroke Is., Qld., VIII-20-58, on *Boronia rosmarinifolia*.

Leioproctus ornatissimus (Cockerell)

Ipswich, Qld., IX-28-58, on *Eucalyptus tereticornis* P.

Leioproctus semipurpureus (Cockerell)

Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis* P.; Ipswich, Qld., IX-28-58, on *Eucalyptus tereticornis* P.; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris* P.; Samford, Qld., I-1-59, on *Eucalyptus tessellaris* P., and *Eucalyptus melanophloia* P.

Leioproctus truncatulus (Cockerell)

Dunwich, Stradbroke Is., Qld., VIII-20-58, on

Dillwynia peduncularis and *Aotus lanigera*; Beerwah, Qld., VIII-29-58, on *Pultenaea villosa* P.

Leioproctus unguidentatus, new species

Dunwich, Stradbroke Is., Qld., VIII-21-58, on *Dillwynia peduncularis* P.

Leioproctus bipectinatus (Smith)

Beerwah, Qld., I-6-59, on *Persoonia virgata* P.

Leioproctus incanescens (Cockerell)

Lamington Natl. Park, Qld., XII-7-58, on *Personia lanceolata* P. C.

Leioproctus speculiferus (Cockerell)

Beerwah, Qld., I-6-59, on *Persoonia virgata* P.; Beerwah, Qld., II-17-59, on *Persoonia virgata* P.

Leioproctus helichrysi (Cockerell)

Tamborine Mt., Qld., II-20-59, on *Erigeron floribundus* C., and on *Helichrysum* sp. near *apiculatum* P. C.

Leioproctus microsomus, new species

17 miles south of Dalby, Qld., X-20-58, on *Wahlenbergia* P. C.; Jondaryan, Qld., X-20-58, on *Wahlenbergia* P.

Leioproctus wahlenbergiae, new species

17 miles south of Dalby, Qld., X-20-58, on *Wahlenbergia* P. C.; Jondaryan, Qld., X-20-58, on *Wahlenbergia* P.; Clifton, Qld., II-26-59, on *Wahlenbergia* P.

Leioproctus caeruleotinctus (Cockerell) = *turneri* (Cockerell)

17 miles south of Dalby, Qld., X-20-58, on *Wahlenbergia*; 10 miles south of Condamine, Qld., X-23-58, on *Cassia circinata* P. C.; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris* P.

Leioproctus crenulatus, new species

Wallangarra, Qld., XI-7-58, on *Pultenaea*.

Leioproctus moretonianus (Cockerell)

Capalaba, Qld., X-13-58, on *Velleia spathulata* P.; Jimboomba, Qld., X-31-58, on *Velleia spathulata* P.; Beenleigh, Qld., XI-22-58, on *Goodenia paniculata*; Capalaba, Qld., II-20-59, on *Velleia spathulata* P.

Paracolletes crassipes Smith

Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Leptospermum brachyandrum*.

Trichocolletes hackeri (Cockerell)

Bunya Mts., Qld. (3000 ft.), X-24-58, on *Solanum furfuraceum* P. C.

Trichocolletes marginatulus, new species

Dunwich, Stradbroke Is., Qld., VIII-21-58, on *Dillwynia peduncularis* and *Aotus lanigera*.

Trichocolletes venustus (Smith)

Brisbane, Qld., IX-10-58, on *Pultenaea villosa*; Brisbane, Qld., VIII-28-58, on *Leptospermum flavescens*; Dunwich, Stradbroke Is., Qld., VIII-20-58, on *Dillwynia peduncularis* and *Aotus lanigera*; Beerwah, Qld., VIII-29-58, on *Aotus lanigera*; Ipswich, Qld., IX-4-58, on *Pultenaea villosa* P. and on *Daviesia squarrosa* P. C.; Capalaba, Qld., IX-6-58, on *Daviesia umbellulata* P. C.; Ipswich, Qld., IX-9-58, on *Pultenaea villosa*; Capalaba, Qld., IX-15-58, on *Daviesia umbellulata* P.; Capalaba, Qld., IX-20-58, on *Daviesia umbellulata* P.; Capalaba, Qld., IX-28-58, on *Daviesia umbellulata* P.; The Summit, Qld., IX-30-58, on *Mirbelia* sp. near *aotoides* P., and on *Pultenaea microphylla*; Cotton Vale, Qld., IX-29-58, on *Daviesia corymbosa*.

Euryglossa hyphesmoides, new species

Mutdapilly, Qld., X-3-58, on *Eucalyptus tereticornis*.

Euryglossa neglectula Cockerell

Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Samford, Qld., I-1-59, on *Eucalyptus tessellaris*.

Euryglossa perkinsi, new species

17 miles south of Dalby, Qld., X-20-58, on *Wahlenbergia*.

Euryglossa wahlenbergiae, new species

Helidon, Qld., X-20-58, on *Wahlenbergia* C.; Glen Innes, N.S.W., XI-6-58, on *Wahlenbergia*; Stanthorpe, Qld., XI-7-58, on *Wahlenbergia*; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Wahlenbergia* C.; Helidon, Qld., I-8-59, on *Wahlenbergia* C.; Warwick, Qld., III-16-59, on *Wahlenbergia*.

Euryglossa walkeriana Cockerell

Noosa, Qld., IV-5-59, on *Banksia*.

Euryglossa chrysoceras Cockerell

Tamborine, Qld., XII-18-58, on *Angophora intermedia*; 8 miles southwest of Rathdowney, Qld., X-31-58, on *Melaleuca bracteata*; Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Deepwater, N.S.W., XI-1-58, on *Leptospermum*;

Mutdapilly, Qld., XI-9-58, on *Melaleuca irbyana*; Samford, Qld., I-1-59, on *Eucalyptus melanophloia*.

Euryglossa ephippiata Smith

8 miles southwest of Rathdowney, Qld., X-31-58, on *Melaleuca bracteata*; Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris*.

Euryglossa obscura Cockerell

Wallangarra, Qld., XI-7-58, on *Jacksonia scoparia*.

Euryglossa reginae Cockerell

Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris*.

Euryglossa subsericea Cockerell

Samford, Qld., I-1-59, on *Eucalyptus tessellaris*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris* C.; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Beerwah, Qld., XI-27-58, on *Tristania suaveolens*; Caboolture, Qld., XI-24-58, on *Melaleuca linariifolia*, and *Melaleuca bracteata* C.; Capalaba, Qld., X-5-58, on *Melaleuca sieberi*; 8 miles southwest of Rathdowney, Qld., X-31-58, on *Melaleuca bracteata* C.; Jimboomba, Qld., XI-31-58, on *Melaleuca linariifolia*; Wallangarra, Qld., X-17-58, on *Leptospermum*; Beenleigh, Qld., XI-22-58, on *Tristania suaveolens*; Moggill, Qld., XII-26-58, on *Angophora subvelutina*; Samford, Qld., I-1-59, on *Eucalyptus melanophloia*; Caboolture, Qld., I-6-59, on *Eucalyptus tessellaris*.

Euryglossa calliopsiformis Cockerell

Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris*.

Euryglossa flavopicta Smith

Samford, Qld., I-1-59, on *Eucalyptus melanophloia*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Mutdapilly, Qld., X-3-58, on *Eucalyptus tereticornis*.

Holohesma semisericea (Cockerell)

13 miles north of Stanthorpe, Qld., XII-29-58, on *Leptospermum brachyandrum*.

Hyphesma barbata (Cockerell)

10 miles west of Maidenwell, Qld., X-24-58, on *Jacksonia scoparia*; Wallangarra, Qld., XI-7-58, on *Leptospermum*; Tamborine, XII-18-58, on *Angophora intermedia* C.

Pachyprosopis aurantipes Cockerell

Capalaba, Qld., X-5-58, on *Callistemon salignus*; Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*; Wallangarra, Qld., XI-7-58, on *Jacksonia scoparia*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*.

Pachyprosopis haematostoma Cockerell

Capalaba, Qld., X-5-58, on *Callistemon salignus*; 8 miles southwest of Rathdowney, Qld., X-31-58, on *Melaleuca bracteata*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*.

Pachyprosopis mirabilis Perkins

Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Capalaba, Qld., X-5-58, on *Callistemon salignus*; Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*; Caboolture, Qld., I-6-59, on *Angophora woodsiana*.

Pachyprosopis obesa Cockerell

Capalaba, Qld., XII-27-56, on *Angophora woodsiana*.

Pachyprosopis humeralis Cockerell

Glenmorgan Qld., X-22-58, on *Melaleuca* and *Callistemon*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*.

Euryglossina flaviventris Cockerell

Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis* C.; Ipswich, Qld., IX-28-58, on *Eucalyptus tereticornis* C.; Muddapilly, Qld., X-3-58, on *Eucalyptus tereticornis* C.; Capalaba, Qld., X-5-58, on *Callistemon salignus* C.; Capalaba, Qld., X-13-58, on *Callistemon salignus* C.; Moggill, Qld., X-19-58, on *Callistemon viminalis*; Muddapilly, Qld., XI-9-58, on *Melaleuca irbyana*; Tamborine, Qld., XII-18-58, on *Angophora costata*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*; Moggill, Qld., XII-26-58, on *Angophora subvelutina*; Samford, Qld., I-1-59, on *Eucalyptus melanophloia*; Caboolture, I-6-59, on *Angophora woodsiana* and *Eucalyptus tessellaris*.

Euryglossina hypochroma Cockerell

Ipswich, Qld., IX-28-58, on *Eucalyptus tereticornis*; Deepwater, N.S.W., XI-1-58, on *Leptospermum* sp.; 8 miles west of Armidale, N.S.W. XI-3-58, on *Eucalyptus*; Wallangarra, Qld., XI-7-58, on *Leptospermum*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Moggill, Qld., XII-26-58, on *Angophora subvelutina*; Samford, Qld., I-1-59, on *Eucalyptus melanophloia*.

Euryglossina personata Cockerell

Capalaba, Qld., IX-28-58, on *Melaleuca sieberi*; Capalaba, Qld., X-13-58, on *Callistemon salignus* C.; Glenmorgan, Qld., X-22-58, on *Melaleuca* C. and *Callistemon* C.; Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Caboolture, Qld., I-6-59, on *Angophora woodsiana*.

Euryglossina semiflava Cockerell

Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis* C.

Euryglossina flavolateralis, new species

Capalaba, Qld., X-5-58, on *Callistemon salignus*; Capalaba, Qld., X-13-58, on *Callistemon salignus*; Moggill, Qld., X-19-58, on *Callistemon viminalis*; Tamborine, Qld., XII-18-58, on *Angophora costata*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*.

Euryglossina fusciventris (Cockerell)

Capalaba, Qld., IX-28-58, on *Melaleuca sieberi*; Capalaba, Qld., X-5-58, on *Melaleuca sieberi*; Capalaba, Qld., X-5-58, on *Callistemon viminalis* C.; Capalaba, Qld., X-13-58, on *Callistemon salignus* C.; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Leptospermum brachyandrum*.

Euryglossina globuliceps (Cockerell)

Wallangarra, Qld., XI-7-58, on *Leptospermum*; Lamington Natl. Park. Qld., XII-7-58, on *Lomatia silaifolia*.

Euryglossina intermedia, new species

Wallangarra, Qld., XI-7-58, on *Leptospermum* C.

Euryglossina macrostoma (Cockerell)

Capalaba, Qld., IX-28-58, on *Melaleuca sieberi*.

Euryglossina nothula (Cockerell)

Brisbane, Qld., XI-29-58, on *Eugenia ventenatii* C.; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris* C.

Euryglossina subnothula (Cockerell)

Capalaba, Qld., IX-15-58, on *Leptospermum flavescens*; Capalaba, Qld., IX-20-58, on *Leptospermum flavescens*; Capalaba, Qld., X-5-58, on *Melaleuca sieberi*; Capalaba, Qld., X-13-58, on *Callistemon salignus*.

Euryglossina cornuta (Cockerell)

Capalaba, Qld., X-13-58, on *Callistemon salignus*.

Euryglossina perkinsi, new species

Lamington Natl. Park, Qld., XII-7-58, on *Claoxylon australis*; Tamborine, Qld., XII-18-58, on *Angophora costata*.

Euryglossina mellea (Cockerell)

Capalaba, Qld., X-13-58, on *Callistemon salignus*.

Euryglossula chalcosoma (Cockerell)

Wallangarra, Qld., XI-7-58, on *Leptospermum*; 10 miles north of Armidale, N.S.W., XI-6-58, on *Eucalyptus*; Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis* C.; Ipswich, Qld., IX-28-58, on *Eucalyptus tereticornis*; Mutdapilly, Qld., IX-3-58, on *Eucalyptus tereticornis*; Capalaba, Qld., X-5-58, on *Callistemon salignus*; Capalaba, Qld., X-13-58, on *Callistemon salignus*; 10 miles west of Maidenwell, Qld., X-24-58, on *Jacksonia scoparia*; Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Deepwater, N.S.W., XI-1-58, on *Leptospermum*; Mutdapilly, Qld., XI-9-58, on *Melaleuca irbyana*; Tamborine, Qld., XII-18-58, on *Angophora intermedia* C.; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*.

Brachyhesma incompleta, new species

Tamborine, Qld., XII-18-58, on *Angophora intermedia* C.; Capalaba, Qld., XII-27-58, on *Angophora woodsiana*; Samford, Qld., I-1-59, on *Eucalyptus tessellaris*.

Hylaeus eugeniellus (Cockerell)

Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Ipswich, Qld., IX-28-58, on *Eucalyptus tereticornis*; Mutdapilly, Qld., X-3-58, on *Eucalyptus tereticornis*; Capalaba, Qld., X-13-58, on *Callistemon salignus*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Samford, Qld., I-1-59, on *Eucalyptus tessellaris*.

Hylaeus fredrici (Cockerell)

Deepwater, N.S.W., XI-1-58, on *Leptospermum*; Wallangarra, Qld., XI-7-58, on *Leptospermum* C. and on *Jacksonia scoparia*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*.

Hylaeus melanops (Cockerell)

Mt. Glorious, Qld., X-9-58, on *Rubus rosae-folius*; 10 miles west of Maidenwell, Qld., X-24-58, on *Jacksonia scoparia*; The Summit, Qld., XI-7-58, on *Jacksonia scoparia*.

Hylaeus perhumilis (Cockerell)

Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis* C.; Gladstone, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Mutdapilly, Qld., X-3-58,

on *Eucalyptus tereticornis*; Moggill, Qld., X-19-58, on *Callistemon viminalis*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris* C.; Caboolture, Qld., I-6-59, on *Angophora woodsiana* and *Eucalyptus tessellaris*; Capalaba, Qld., II-20-59, on *Eucalyptus intermedia*.

Hylaeus quadratus (Smith)

Wallangarra, Qld., XI-7-58, on *Leptospermum*; Lamington Natl. Park, Qld., XII-7-58, on *Lomatia silaifolia*.

Hylaeus serotinellus (Cockerell)

Wallangarra, Qld., XI-7-58, on *Leptospermum* C., and on *Jacksonia scoparia*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Leptospermum brachyandrum*.

Hylaeus ofarrelli, new species

Lamington Natl. Pk., Qld., XII-7-58, on *Claoxylon australis*.

Hylaeus ceniberus (Cockerell)

13 miles north of Stanthorpe, Qld., XII-29-58, on *Leptospermum brachyandrum*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Gladstone, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Capalaba, Qld., X-5-58, on *Callistemon salignus*; Capalaba, Qld., X-13-58, on *Callistemon salignus*; Glenmorgan, Qld., X-22-58, on *Melaleuca* C. and *Callistemon* C.; Jimboomba, Qld., X-31-58, *Melaleuca linariifolia*.

Hylaeus constrictus (Cockerell)

Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Leptospermum brachyandrum*; Tamborine, Qld., III-22-59, on *Alphitonia excelsa*; Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*.

Hylaeus coronatus (Cockerell)

Stanthorpe, Qld., X-17-58, on *Jacksonia scoparia*; Wallangarra, Qld., X-17-58, on *Leptospermum* and *Jacksonia scoparia*.

Hylaeus maiellus Rayment

Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*.

Hylaeus aureopictus (Cockerell)

The Summit, Qld., IX-30-58, on *Boronia granitica*.

Hylaeus eburniellus (Cockerell)

Tamborine, Qld., XII-18-58, on *Angophora intermedia*.

Hylaeus amiculinus (Cockerell)

Wallangarra, Qld., XI-7-58, on *Leptospermum* and *Jacksonia scoparia*; The Summit, Qld., XI-7-58, on *Xanthorrhoea*; Beerwah, Qld., IX-19-58, on *Melaleuca sieberi*; Capalaba, Qld., X-5-58, on *Melaleuca sieberi*; Capalaba, Qld., X-5-58, on *Callistemon salignus*; Capalaba, Qld., X-13-58, on *Callistemon salignus*; Moggill, Qld., X-19-58, on *Callistemon viminalis* C.; Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*; Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Muttapilly, Qld., XI-9-58, on *Melaleuca irbyana*; Moggill, Qld., XI-31-58, on *Melaleuca bracteata*; Caboolture, Qld., XI-24-58, on *Melaleuca bracteata*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*.

Hylaeus chromaticus (Cockerell)

Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*; Moggill, Qld., X-19-58, on *Callistemon viminalis* C.; Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Capalaba, Qld., IX-15-58, on *Leptospermum flavescens*; Capalaba, Qld., IX-28-58, on *Melaleuca sieberi*; Ipswich, Qld., IX-28-58, on *Eucalyptus tereticornis*; Capalaba, Qld., X-5-58, on *Melaleuca sieberi*; Capalaba, Qld., X-5-58, on *Callistemon salignus* C.; The Summit, Qld., IX-30-58, on *Boronia granitica*; Capalaba, Qld., X-13-58, on *Callistemon salignus* C.; 8 miles southwest of Rathdowney, Qld., X-31-58, *Melaleuca bracteata* C.; Jimboomba, Qld., X-31-58, *Melaleuca linariifolia*; Tamborine, Qld., III-22-58, on *Alphitonia excelsa*; Wallangarra, Qld., XI-7-58, on *Leptospermum*; Muttapilly, Qld., XI-9-58, on *Melaleuca irbyana*; Moggill, Qld., XI-13-58, on *Melaleuca bracteata*; Caboolture, Qld., XI-24-58, on *Melaleuca bracteata*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris*; Samford, Qld., I-1-59, on *Eucalyptus tessellaris*; 3 miles west of Cunningham's Gap, Qld., II-25-59, on *Bursaria spinosa*.

Hylaeus euxanthus (Cockerell)

Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris* C.

Hylaeus hackeri (Cockerell)

Capalaba, Qld., X-5-58, on *Callistemon salignus*; Capalaba, Qld., X-13-58, on *Callistemon salignus*; Muttapilly, Qld., XI-9-58, on *Melaleuca irbyana*; Caboolture, Qld., XI-24-58, on *Melaleuca bracteata* and *Melaleuca linariifolia*; Brisbane, Qld., XI-29-58, on *Eugenia ventenatii*.

Hylaeus simpliciventris (Cockerell)

Capalaba, Qld., X-13-58, on *Callistemon salignus*; Caboolture, Qld., XI-24-58, on *Melaleuca bracteata*.

Hylaeus theodori (Perkins)

Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*.

Hylaeus disjunctus (Cockerell)

Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Gladstone, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Moggill, Qld., X-19-58, on *Callistemon viminalis*; 8 miles southwest of Rathdowney, Qld., X-31-58, on *Melaleuca bracteata*; Muttapilly, Qld., XI-9-58, on *Melaleuca irbyana*; Caboolture, Qld., XI-24-58, *Melaleuca bracteata*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris*; Samford, Qld., I-1-59, on *Eucalyptus tessellaris* and *melanophloia*; Caboolture, Qld., I-6-59, on *Eucalyptus tessellaris*.

Hylaeus elegans (Smith)

Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*; Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Gladstone, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*; 8 miles southwest of Rathdowney, Qld., X-31-58, on *Melaleuca bracteata*; Deepwater, N.S.W., XI-1-58, on *Leptospermum* C.; Muttapilly, Qld., XI-9-58, on *Melaleuca irbyana*; Tamborine, Qld., XII-18-58, on *Angophora intermedia* and *costata*; Samford, Qld., I-1-59, on *Eucalyptus tessellaris* and *melanophloia*.

Hylaeus obtusatus (Smith)

Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Caboolture, Qld., XI-24-58, on *Melaleuca bracteata*; Moggill, Qld., XI-13-58, on *Melaleuca bracteata*; Moggill, Qld., X-19-58, on *Callistemon viminalis*; 10 miles west of Maidenwell, Qld., X-24-58, on *Jacksonia scoparia*; 8 miles southwest of Rathdowney, Qld., X-31-58, on *Melaleuca bracteata*; Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Wallangarra, Qld., XI-7-58, on *Leptospermum*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*; 3 miles west of Cunningham's Gap, Qld., II-25-59, on *Bursaria spinosa*.

Hylaeus ruficeps (Smith)

Samford, Qld., I-1-59, on *Eucalyptus tessellaris*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris*.

laris; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Moggill, Qld., XI-13-58, on *Melaleuca bracteata*; Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Mutdapilly, Qld., XI-9-58, on *Melaleuca irbyana*.

Hylaeus albocuneatus (Cockerell)

Helidon, Qld., X-20-58, on *Wahlenbergia*; Deepwater, N.S.W., XI-1-58, on *Wahlenbergia* C.; Glen Innes, N.S.W., XI-6-58, on *Wahlenbergia*; Stanthorpe, Qld., XI-7-58, on *Wahlenbergia*.

Hylaeus multigibbosus, new species

Jondaryan, Qld., X-20-58, on *Wahlenbergia*.

Hylaeus kelvini (Cockerell)

Brisbane, Qld., I-10-59, on *Jacksonia scoparia*.

Hylaeus scutalicornis, new species

Cotton Vale, Qld., IX-29-58, on *Daviesia corymbosa*.

Heterapoides hackeriella (Cockerell)

The Summit, Qld., XI-7-58, on *Xanthorrhoea*; Ipswich, Qld., IX-28-58, on *Eucalyptus tereticornis*; The Summit, Qld., IX-30-58, on *Calytrix tetragona*; Capalaba, Qld., X-5-58, on *Callistemon salignus*; The Summit, Qld., IX-30-58, on *Boronia granitica*; Capalaba, Qld., X-13-58, on *Callistemon salignus* C.; Moggill, Qld., X-19-58, on *Callistemon viminalis*; 10 miles west of Maidenwell, X-24-58, on *Jacksonia scoparia*; Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Deepwater, N.S.W., XI-1-58, on *Leptospermum*; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Leptospermum brachyandrum*; Capalaba, Qld., XII-27-58, on *Angophora woodsiana*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*; Wallangarra, Qld., XI-7-58, on *Leptospermum* and *Jacksonia scoparia* C.; Lamington Natl. Park, Qld., XII-7-58, on *Lomatia silaifolia* and *Claoxylon australe*; Tamborine, Qld., XII-18-58, on *Angophora intermedia* and *Angophora costata*; Caboolture, Qld., I-6-59, on *Eucalyptus tessellaris*; Brisbane, Qld., I-10-59, on *Jacksonia scoparia*; 3 miles west of Cunningham's Gap, Qld., II-25-59, on *Bursaria spinosa*; Tamborine, Qld., III-22-59, on *Alphitonia excelsa*.

Hylaeorhiza nubilosa (Smith)

Caboolture, Qld., XI-24-58, on *Melaleuca bracteata*; Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Beerwah, Qld., IX-19-58, on *Melaleuca sieberi*; Capalaba, Qld., X-5-58, on *Callistemon salignus*; The Summit, Qld., IX-30-58, on *Boronia granitica*; Moggill, Qld., X-19-58, on *Callistemon viminalis*; Deepwater, N.S.W., XI-1-58, on *Leptospermum*; The Summit, Qld.,

XI-7-58, on *Xanthorrhoea*; Wallangarra, Qld., XI-7-58, on *Leptospermum*; Beerwah, Qld., XI-27-58, on *Tristania suaveolens*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*.

Hemirhiza mellicept (Cockerell)

Tamborine Mt., Qld., II-20-59, on *Erigeron floribundus*.

Amphylaeus mediostictus (Cockerell)

Beerwah, Qld., IX-19-58, on *Melaleuca sieberi* and *Melaleuca nodosa*; The Summit, Qld., IX-30-58, on *Boronia granitica*; Mt. Glorious, Qld., X-9-58, on *Rubus rosaefolius*; Bunya Mts., Qld. (3000 ft.), X-24-58, on *Solanum furfuraceum*.

Amphylaeus nubilosellus (Cockerell)

Wallangarra, Qld., XI-7-58, on *Jacksonia scoparia*.

Meroglossa impressifrons Smith

The Summit, Qld., IX-30-58, on *Boronia granitica*.

Meroglossa nigrifrons Smith

The Summit, Qld., IX-30-58, on *Leptospermum attenuatum* and *Boronia granitica*; The Summit, Qld., XI-7-58, on *Xanthorrhoea*.

Meroglossa penetrata Smith

Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis*; The Summit, Qld., IX-30-58, on *Leptospermum attenuatum*; Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*; Stanthorpe, Qld., XI-7-58, on *Jacksonia scoparia*.

Meroglossa punctata Rayment

The Summit, Qld., IX-30-58, on *Leptospermum attenuatum*.

Meroglossa torrida Smith

Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*.

Hyleoides bivulnerata Cockerell

Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*.

Hyleoides concinna (Fabricius)

Brisbane, Qld., I-10-59, on *Jacksonia scoparia*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris*; Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*; 10 miles west of Maidenwell, Qld., X-24-58, on *Jacksonia scoparia*; Wallangarra, Qld., XI-7-58, on *Jacksonia scoparia*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*.

Nomia australica Smith

Brisbane, Qld., IX-10-58, on *Leptospermum flavescens* P.; Capalaba, Qld., IX-20-58, on *Hibbertia linearis* P.; Capalaba, Qld., X-5-58, on *Hibbertia linearis* P.; Minden, Qld., X-19-58, on *Cassia occidentalis schinifolia* P.; Beerwah, Qld., XI-14-58, on *Melastoma polyanthum* P.

Nomia brisbanensis Cockerell

Capalaba, Qld., IX-20-58, on *Hibbertia linearis* P.; The Summit, Qld., IX-30-58, on *Boronia granitica*; 8 miles west of Armidale, N.S.W., XI-3-58, on *Hibbertia linearis* P.; 11 miles south of Uralla, N.S.W., XI-5-58, on *Daviesia latifolia* P.; 10 miles north of Armidale, N.S.W., XI-6-58, on *Pultenaea* P. C.

Nomia ferricauda Cockerell

Capalaba, Qld., X-5-58, on *Melaleuca sieberi*; Glenmorgan, Qld., X-22-58, on *Melaleuca* P. and *Callistemon* P.; Brisbane, Qld., I-10-59, on *Jacksonia scoparia* P.

Nomia flavoviridis Cockerell

Helidon, Qld., X-20-58, on *Wahlenbergia*; Beerwah, Qld., XI-24-58, on *Melastoma polyanthum* P.; Brisbane, Qld., I-10-59, on *Jacksonia scoparia* P.

Nomia halictella Cockerell

Mutdapilly, Qld., XI-9-58, on *Melaleuca irbyana*; Clifton, Qld., II-26-59, on *Wahlenbergia*.

Lasioglossum fulvofasciae, new species

3 miles west of Cunningham's Gap, Qld., II-25-59, on *Bursaria spinosa* C.

Lasioglossum insculptum (Cockerell)

3 miles west of Cunningham's Gap, Qld., II-25-59, on *Bursaria spinosa*.

Lasioglossum peraustrale (Cockerell)

Beerwah, Qld., XI-27-58, on *Tristania suaveolens*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris*; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Leptospermum brachyandrum*; 3 miles west of Cunningham's Gap, Qld., II-25-59, on *Bursaria spinosa*.

Lasioglossum cervicale (Cockerell)

The Summit, Qld., IX-30-58, on *Boronia granitica* P.

Lasioglossum hirtiventre (Cockerell)

The Summit, Qld., X-30-58, on *Boronia granitica*; 8 miles west of Armidale, N.S.W., XI-

3-58, on *Hibbertia linearis* P. and on *Eucalyptus*; 11 miles south of Uralla, N.S.W., XI-5-58, on *Daviesia latifolia* P.

Lasioglossum leichardti (Cockerell)

Tamborine Mt., Qld., II-20-59, on *Erigeron floribundus* P.

Lasioglossum musicum (Cockerell)

Mt. Glorious, Qld., X-9-58, on *Rubus rosae-folius*; Bunya Mts., Qld. (3000 ft.), X-24-58, on *Solanum furfuraceum* P.; Tamborine Mt., Qld., II-20-59, on *Erigeron floribundus*.

Lasioglossum speculiferum (Cockerell)

The Summit, Qld., IX-30-58, on *Boronia granitica* P.; 8 miles west of Armidale, N.S.W., XI-3-58, on *Wahlenbergia*; 10 miles north of Armidale, N.S.W., XI-6-58, on *Pultenaea* P.; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris*.

Lasioglossum imitator, new species

Bunya Mountains, Qld. (3000 ft.), X-24-58, on yellow composite P.; Guyra, N.S.W., XI-6-58, on *Heliopsis anthemoides*, *Helichrysum bracteatum*, and *Hypochoeris radicata* C.P.; Glen Innes, N.S.W., XI-6-58, on *Leptorhynchus squamatus* P.; 11 miles south of Uralla, N.S.W., XI-5-58, on *Daviesia latifolia*.

Lasioglossum clarigaster (Cockerell)

Dunwich, Stradbroke Is., Qld., VIII-20-58, on *Hibbertia linearis*.

Lasioglossum atrocyanum (Cockerell)

8 miles west of Armidale, N.S.W., XI-3-58, on *Hibbertia linearis* P.; Glenn Innes, N.S.W., XI-6-58, on *Wahlenbergia* P.

Lasioglossum cephalochilum, new species

Glen Innes, N.S.W., XI-6-58, on *Leptorhynchus squamatus* P.C.

Lasioglossum erythrurum (Cockerell)

Dunwich, Stradbroke Is., Qld., VIII-12-58, on *Dillwynia peduncularis* and *Aotus lanigera*; The Summit, Qld., IX-30-58, on *Boronia granitica*; 8 miles west of Armidale, N.S.W., XI-3-58, on *Hibbertia linearis* P. and *Wahlenbergia* P.; Stanthorpe, Qld., XI-7-58, on *Wahlenbergia* P.; Wallangarra, Qld., XI-7-58, on *Jacksonia scoparia*.

Lasioglossum exceptum (Cockerell)

Mt. Glorious, Qld., X-9-58, on *Rubus rosae-folius* P.; Lamington Natl. Park, Qld., XII-7-58, on *Claoxylon australe* P.

Lasioglossum griseovittatum (Cockerell)

Brisbane, Qld., VIII-28-58, on *Leptospermum flavescens* P.; Beerwah, Qld., VIII-29-58, on *Pultenaea villosa* P. C. and on *Aotus lanigera* P.; Ipswich, Qld., IX-9-58, on *Pultenaea villosa* P.; Brisbane, Qld., IX-10-58, on *Leptospermum flavescens* P.; Mt. Edwards, Qld., IX-28-58, on *Jacksonia scoparia*; Jimboomba, Qld., X-31-58, *Melaleuca linariifolia*.

Lasioglossum gynochilum, new species

Helidon, Qld., X-20-58, on *Wahlenbergia* P. C.; Helidon, Qld., I-8-59, on *Wahlenbergia* P. C.; Clifton, Qld., II-26-59, on *Wahlenbergia* P.

Lasioglossum haematopus (Cockerell)

Brisbane, Qld., XI-29-58, on *Eugenia venetati*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris*.

Lasioglossum idoneum (Cockerell)

The Summit, Qld., IX-30-58, on *Pultenaea microphylla* P.; 15 miles southwest of Legume, N.S.W., X-31-58, on *Jacksonia scoparia*; 10 miles north of Armidale, N.S.W., XI-6-58, on *Pultenaea*; The Summit, Qld., XI-7-58, on *Jacksonia scoparia* P.; Stanthorpe, Qld., XI-7-58, on *Jacksonia scoparia* P.

Lasioglossum lanarium (Smith)

8 miles west of Armidale, N.S.W., XI-3-58, on *Wahlenbergia* P.; Beerwah, Qld., VIII-29-58, on *Leptospermum*; Beerwah, Qld., IX-19-58, on *Hibbertia linearis* P.; The Summit, Qld., IX-30-58, on *Pultenaea microphylla*; Deepwater, N.S.W., XI-1-58, on *Leptospermum*; Deepwater, N.S.W., XI-1-58, on *Jacksonia scoparia* P.; 15 miles southwest of Legume, N.S.W., X-31-58, on *Jacksonia scoparia* P.

Lasioglossum languinosum (Smith)

The Summit, Qld., XI-7-58, on *Jacksonia scoparia*; Stanthorpe, Qld., XI-7-58, on *Jacksonia scoparia*; Lamington Natl. Park, Qld., VII-7-58, on *Taraxacum* P.

Lasioglossum leai (Cockerell)

Capalaba, Qld., IX-28-58, on *Melaleuca sieberi* P.; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris* P.

Lasioglossum obscurissimum, new species

Helidon, Qld., X-20-58, on *Wahlenbergia* P. C.; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Wahlenbergia*; Helidon, Qld., I-8-59, on *Wahlenbergia* P. C.; Warwick, Qld., III-16-59, on *Wahlenbergia* P. C.

Lasioglossum orbatum (Smith)

Ipswich, Qld., IX-4-58, on *Pultenaea villosa* P.; The Summit, Qld., IX-30-58, on *Pultenaea microphylla* P.; Cotton Vale, Qld., IX-29-58, on *Daviesia corymbosa* P.; 17 miles south of Dalby, Qld., X-20-58, on *Swainsona galegifolia* P.; 15 miles southwest of Legume, N.S.W., X-31-58, on *Jacksonia scoparia* P.; 11 miles south of Uralla, N.S.W., XI-5-58, on *Daviesia latifolia* P.; Wallangarra, Qld., XI-7-58, on *Jacksonia scoparia* P. C.

Lasioglossum pulvitectum (Cockerell)

Dunwich, Stradbroke Is., Qld., VIII-12-58, on *Dillwynia peduncularis* and *Aotus lanigera*.

Lasioglossum subinclinans (Cockerell)

15 miles southwest of Legume, N.S.W., X-31-58, on *Jacksonia scoparia*.

Lasioglossum vitripenne (Smith)

Lamington Natl. Park, Qld., XII-7-58, on *Taraxacum*; Mutdapilly, Qld., XI-9-58, on *Melaleuca irbyana* P. C.; Ipswich, Qld., IX-28-58, on *Eucalyptus tereticornis* P. C.; Mutdapilly, Qld., X-3-58, on *Eucalyptus tereticornis* P. C.; Capalaba, Qld., X-5-58, on *Callistemon salignus* P.; The Summit, Qld., IX-30-58, on *Boronia granitica*; 10 miles west of Maidenwell, Qld., X-24-58, on *Jacksonia scoparia*; 8 miles southwest of Rathdowney, Qld., X-31-58, on *Melaleuca bracteata* P.; Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Tamborine, Qld., XII-18-58, on *Angophora intermedia* and *costata*; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris* P. C.; Moggill, Qld., XII-26-58, on *Angophora subvelutina* P.; 13 miles south of Warwick, Qld., XII-29-58, on *Eucalyptus crebra* P.; Samford, Qld., I-1-59, on *Eucalyptus tessellaris* P. C., and *Eucalyptus melanophloia* P. C.; Tibrogargen, near Beerwah, Qld., I-6-59, on *Baeckea* P.; Caboolture, Qld., I-6-59, on *Angophora woodsiana* P. and *Eucalyptus tessellaris* P. C.; Capalaba, Qld., II-20-59, on *Eucalyptus intermedia*; Tamborine, Qld., III-22-59, on *Alphitonia excelsa*.

Lasioglossum wahlenbergiae, new species

Helidon, Qld., X-20-58, on *Wahlenbergia* P. C.; 8 miles west of Armidale, N.S.W., XI-3-58, on *Wahlenbergia* P. C.; 11 miles south of Uralla, N.S.W., XI-6-58, on *Wahlenbergia* P.; Glen Innes, N.S.W., XI-6-58, on *Wahlenbergia* P. C.; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Wahlenbergia*; Warwick, Qld., II-26-59, on *Wahlenbergia* P.; Warwick, Qld., III-16-59, on *Wahlenbergia* P.

Homalictus dampieri (Cockerell)

Wallangarra, Qld., XI-7-58, on *Jacksonia scoparia*; Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis* P. C.; Gladstone, Qld., VIII-12-58, on *Eucalyptus tereticornis* P.; Ipswich, IX-28-58, on *Eucalyptus tereticornis* P. C.; Mutdapilly, Qld., X-3-58, on *Eucalyptus tereticornis* P. C.; Moggill, Qld., X-19-58, on *Callistemon viminalis* P.; 27 miles east of Condamine, Qld., X-21-58, on yellow composite P. C.; Jimboomba, Qld., X-31-58, *Malaleuca linariifolia* P. C.; Mutdapilly, Qld., XI-9-58, on *Melaleuca irbyana* P. C.; Moggill, Qld., XI-13-58, on *Melaleuca bracteata*; Brisbane, Qld., XI-29-58, on *Eugenia ventenatii*; Tamborine, Qld., XII-18-58, on *Angophora intermedia* C.; Brisbane, Qld., XII-26-58, on *Eucalyptus tessellaris* P. C.; 13 miles south of Warwick, Qld., XII-29-58, on *Eucalyptus crebra* P.; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Leptospermum brachyandrum*; Samford, Qld., I-1-59, on *Eucalyptus tessellaris* and *Eucalyptus melanophloia* P.; Caboolture, Qld., I-6-59, on *Angophora woodsiana* P. and on *Eucalyptus tessellaris* P.; Capalaba, Qld., II-20-59, on *Eucalyptus intermedia* P.; 3 miles west of Cunningham's Gap, Qld., II-25-59, on *Bursaria spinosa*; Tamborine, Qld., III-22-59, on *Alphitonia excelsa*.

Homalictus dotatus (Cockerell)

13 miles south of Warwick, Qld., XII-29-58, on *Eucalyptus crebra* P.; Moggill, Qld., XII-26-58, on *Angophora subvelutina* P.; 17 miles south of Dalby, Qld., X-20-58, on *Wahlenbergia* P.; Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*; Deepwater, N.S.W., XI-1-58, on *Leptospermum*; 8 miles west of Armidale, N.S.W., XI-3-58, on *Eucalyptus*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris* P.; Samford, Qld., I-1-59, on *Eucalyptus tessellaris* P. and on *Eucalyptus melanophloia* P.; Caboolture, Qld., I-6-59, on *Angophora woodsiana* P. and on *Eucalyptus tessellaris* P.

Homalictus eyrei (Cockerell)

Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis* P. C.; Gladstone, Qld., VIII-12-58, on *Eucalyptus tereticornis* P.; Ipswich, Qld., IX-28-58, on *Eucalyptus tereticornis* P. C.; Capalaba, Qld., X-5-58, on *Callistemon salignus* P.; Wallangarra, Qld., XI-7-58, on *Jacksonia scoparia*.

Homalictus limatifomis (Cockerell)

13 miles north of Stanthorpe, Qld., XII-29-58, on *Wahlenbergia*; Helidon, Qld., X-20-58, on *Wahlenbergia*; Glen Innes, N.S.W., XI-6-58, on *Wahlenbergia* P.; Guyra, N.S.W., XI-6-58, on

Helipterum anthemoides P., *Helichrysum bracteatum* P., and *Hypochaeris radicata* P.

Homalictus oxoniellus (Cockerell)

The Summit, Qld., IX-30-58, on *Boronia granitica*; Mt. Glorious, Qld., X-9-58, on *Hibbertia*.

Homalictus punctatus (Smith)

Ipswich, Qld., IX-28-58, on *Eucalyptus tereticornis*; Mutdapilly, Qld., X-3-58, on *Eucalyptus tereticornis*; The Summit, Qld., IX-30-58, on *Boronia granitica* P.; Deepwater, N.S.W., XI-1-58, on *Leptospermum*; Wallangarra, Qld., XI-7-58, on *Leptospermum*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Leptospermum brachyandrum*.

Homalictus scrupulosus (Cockerell)

Lamington Natl. Park, Qld., XII-7-58, on *Lomatia silaifolia* and on *Claoxylon australis* P. C.

Homalictus suburbanus (Cockerell)

17 miles south of Dalby, Qld., X-20-58, on *Wahlenbergia*; Jondaryan, Qld., X-20-58, on *Wahlenbergia* P.; Helidon, Qld., X-20-58, on *Wahlenbergia* P. C.; Deepwater, N. S. W., XI-1-58, on *Wahlenbergia* P.; 8 miles west of Armidale, N.S.W., XI-3-58, on *Hibbertia linearis* P.; 11 miles south of Uralla, N.S.W., XI-5-58, on *Daviesia latifolia*; Clifton Qld., II-26-59, on *Wahlenbergia* P.; Warwick, Qld., II-26-59, on *Wahlenbergia* P.; Warwick, Qld., III-16-59, on *Wahlenbergia*.

Homalictus urbanus (Smith)

Samford, Qld., I-1-59, on pink-flowered weed P.; The Summit, Qld., XI-7-58, on *Jacksonia scoparia* P.; Dunwich, Stradbroke Is., Qld., VIII-20-58, on *Hibbertia linearis*; Beerwah, Qld., IX-14-58, on *Hibbertia linearis* P.; Beerwah, Qld., IX-19-58, on *Hibbertia linearis* P.; The Summit, Qld., IX-30-58, on *Boronia granitica* P.; Mt. Glorious, Qld., X-9-58, on *Hibbertia* P.; 10 miles west of Maidenwell, Qld., X-24-58, on *Jacksonia scoparia* P.

Nomioides perditella Cockerell

Helidon, Qld., X-20-58, on *Wahlenbergia* P.

Lithurge rubricatus (Smith)

Beerwah, Qld., XI-24-58, on *Hibiscus*.

Chalicodoma mystaceana Michener

Beerwah, Qld., XI-27-58, on *Tristania suaveolens*; Brisbane, Qld., XI-30-58, on *Pongamia pinnata* P. C.

Chalicodoma suffusipennis (Cockerell)

17 miles south of Dalby, Qld., X-20-58, on *Swainsona galegifolia* P.; 10 miles west of Maidenwell, Qld., X-24-58, on *Jacksonia scoparia* P.; Beerwah, Qld., I-6-59, on *Persoonia virgata*.

Chalicodoma trichognatha (Cockerell)

Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*; 15 miles southwest of Legume, N.S.W., X-31-58, on *Jacksonia scoparia*; Wallangarra, Qld., XI-7-58, on *Jacksonia scoparia*; Mutdapilly, Qld., XI-9-58, on *Melaleuca irbyana*; Moggill, Qld., XI-13-58, on *Melaleuca bracteata*; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Leptospermum brachyandrum*.

Chalicodoma abdominalis (Smith)

Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris* P.

Chalicodoma deanii (Rayment)

Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*; Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Mutdapilly, Qld., XI-9-58, on *Melaleuca irbyana*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris*.

Megachile mystacea (Fabricius)

Brisbane, Qld., XI-30-58, on *Pongamia pinnata*.

Megachile chrysopyga Smith

Wallangarra, Qld., XI-7-58, on *Jacksonia scoparia*; Mt. Glorious, Qld., X-9-58, on *Oxylobium ilicifolium*; 15 miles southwest of Legume, N.S.W., X-31-58, on *Jacksonia scoparia*; 11 miles south of Uralla, N.S.W., XI-5-58, on *Daviesia latifolia*; 10 miles north of Armidale, N.S.W., XI-6-58, on *Pultenaea* P.; The Summit, Qld., XI-7-58, on *Jacksonia scoparia* P.

Megachile macularis Dalla Torre

Jondaryan, Qld., X-20-58, on *Wahlenbergia* P.; Stanthorpe, Qld., XI-7-58, on *Jacksonia scoparia*; Wallangarra, Qld., XI-7-58, on *Jacksonia scoparia*.

Megachile quinquelineata Cockerell

Brisbane, Qld., XI-30-58, on *Pongamia pinnata*.

Megachile rhodogastra Cockerell

Brisbane, Qld., XI-30-58, on *Pongamia pinnata*.

Amegilla salteri (Cockerell)

Brisbane, Qld., XI-29-58, on *Bignonia* (cultivated).

Allodapula similima (Smith) and *unicolor* (Smith)¹

Rockhampton, Qld., VIII-12-58, on *Eucalyptus tereticornis*; Stradbroke Is., Qld., VIII-20-58, on *Hibbertia linearis*; Beerwah, Qld., VIII-29-58, on *Pultenaea villosa*; Sarina, Qld., VIII-13-58, on *Acacia* P.; Ipswich, Qld., IX-9-58, on *Jacksonia scoparia* P.; Capalaba, Qld., IX-15-58, on *Leptospermum flavescens*; Beerwah, Qld., IX-19-58, on *Melaleuca nodosa*; Capalaba, Qld., IX-20-58, on *Hibbertia linearis* P.; Mt. Edwards, Qld., IX-29-58, on *Jacksonia scoparia* P.; Capalaba, Qld., X-5-58, on *Callistemon salignus* P.; Capalaba, Qld., X-13-58, on *Velleia spathulata* P.; Glenmorgan, Qld., X-22-58, on *Melaleuca* and *Callistemon*; 8 miles southwest of Rathdowney, Qld., X-31-58, on *Melaleuca bracteata*; Mutdapilly, Qld., XI-9-58, on *Melaleuca irbyana* P.; Beerwah, Qld., XI-27-58, on *Tristania suaveolens*; Tamborine, Qld., XII-18-58, on *Angophora intermedia* and *Angophora costata*; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris*; Samford, Qld., I-1-59, on *Eucalyptus tessellaris* P.; Beerwah, Qld., I-6-59, on *Persoonia virgata* P.; Caboolture, Qld., I-6-59, on *Angophora woodsiana* P.; Noosa, Qld., IV-5-59, on *Leucopogon margarodes*.

Exoneura aterrima Cockerell

Capalaba, Qld., X-5-58, on *Callistemon salignus* P.

Exoneura brisbanensis Cockerell

Capalaba, Qld., II-20-59, on *Eucalyptus intermedia*; Tamborine, Qld., III-22-59, on *Alphitonia excelsa*.

Exoneura concinnula Cockerell

The Summit, Qld., IX-30-58, on *Calytrix tetragona*; The Summit, Qld., XI-7-58, on *Jacksonia scoparia* P.; Wallangarra, Qld., XI-7-58, on *Leptospermum* C. and on *Jacksonia scoparia* P.; Tamborine, Qld., XII-18-58, on *Angophora intermedia* P.; 3 miles west of Cunningham's Gap, Qld., II-22-59, on *Bursaria spinosa*.

Exoneura gracilis Cockerell

Capalaba, Qld., X-5-58, on *Callistemon salignus*.

Exoneura ploratula Cockerell

Capalaba, Qld., X-5-58, on *Callistemon salignus*; The Summit, Qld., XI-7-58, on *Xanthorrhoea* P.; Wallangarra, Qld., XI-7-58, on *Jack-*

¹ Both species were found at most of these localities. Specific identification at the time was not accurate, and there is confusion as to which species were collecting pollen at the various localities, but both species collect from a variety of flowers.

sonia scoparia; 3 miles west of Cunningham's Gap, Qld., II-25-59, on *Bursaria spinosa*.

Exoneura tau Cockerell

The Summit, Qld., IX-30-58, on *Pultenaea microphylla*; Wallangarra, Qld., XI-7-58, on *Leptospermum* C. and on *Jacksonia scoparia* P.; Tamborine, Qld., XII-18-58, on *Angophora intermedia*; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Leptospermum brachyandrum*.

Exoneura baculifera Cockerell

Lamington Natl. Park, Qld., XII-7-58, on *Lomatia silaifolia* and on *Claoxylon australe* P.

Exoneura bicolor Smith

The Summit, Qld., XI-7-58, on *Jacksonia scoparia* P.; Guyra, N.S.W., XI-6-58, on *Helichrysum bracteatum* P.; 10 miles north of Armidale, N.S.W., XI-6-58, on *Pultenaea* P.; 11 miles south of Uralla, N.S.W., XI-5-58, on *Daviesia latifolia* P. C.; The Summit, Qld., IX-30-58, on *Pultenaea microphylla* and on *Boronia granitica* P. C.; Cotton Vale, Qld., IX-29-59, on *Daviesia corymbosa*; 15 miles southwest of Legume, N.S.W., X-31-58, on *Jacksonia scoparia* P.; Deepwater, N.S.W., XI-1-58, on *Pultenaea* P. and on *Jacksonia scoparia* P.; Wallangarra, Qld., XI-7-58, on *Jacksonia scoparia* P.

Exoneura hamulata Cockerell

Beerwah, Qld., I-6-59, on *Persoonia virgata*; Noosa, Qld., IV-5-59, on *Leucopogon margarodes*.

Exoneura hackeri Cockerell

Beerwah, Qld., VIII-29-58, on *Leptospermum*; Capalaba, Qld., IX-20-58, on *Hibbertia linearis* P.

Exoneura oblitterata Cockerell

Capalaba, Qld., IX-6-58, on *Hibbertia linearis* P.; Capalaba, Qld., IX-20-58, on *Hibbertia linearis* P. and on *Leptospermum flavescens* P.; Warwick, Qld., X-1-58, on *Rapistrum rugosum*; 17 miles south of Dalby, Qld., X-20-58, on *Swainsona galegifolia*; 10 miles west of Maidenwell, Qld., X-24-58, on *Jacksonia scoparia* P.; 11 miles south of Uralla, N.S.W., XI-5-58, on *Daviesia latifolia*; Capalaba, Qld., IX-15-58, on *Leptospermum flavescens*; The Summit, Qld., IX-30-58, on *Boronia granitica* P. C.; 15 miles southwest of Legume, N.S.W., XI-1-58, on *Jacksonia scoparia* P.; Deepwater, N.S.W., XI-1-58, on *Leptospermum*; 10 miles north of Uralla, N.S.W., XI-6-58, on *Pultenaea* P.; Glen Innes, N.S.W., XI-6-58, on *Wahlenbergia* P.; Guyra, N.S.W., XI-6-58, on *Helichrysum bracteatum* P.; Wallangarra, Qld., XI-7-58, on *Jacksonia scoparia* P.; The Summit, Qld., XI-7-58, on *Jacksonia scoparia*; Stanthorpe,

Qld., XI-7-58, on *Jacksonia scoparia* P.; 13 miles north of Stanthorpe, Qld., XII-29-58, on *Wahlenbergia* C. and on *Leptospermum brachyandrum*; 3 miles west of Cunningham's Gap, Qld., II-25-59, on *Bursaria spinosa* C.; Noosa, Qld., IV-5-59, on *Leucopogon margarodes*.

Exoneura robusta Cockerell

Mt. Glorious, Qld., X-9-58, on *Rubus rosae-folius* P. and on *Oxylobium ilicifolium*; Lamington Natl. Park, Qld., XII-7-58, on *Lomatia silaifolia*.

Exoneura variabilis Rayment

Lamington Natl. Park, Qld., XII-7-58, on *Lomatia silaifolia*; Tamborine Mt., Qld., II-20-59, on *Erigeron floribundus* P. C. and on *Helichrysum* sp. near *apiculatum* P.; 3 miles west of Cunningham's Gap, Qld., II-25-59, on *Bursaria spinosa*.

Lestis bombylans (Fabricius)

Capalaba, Qld., IX-20-58, on *Hibbertia linearis* P. and on *Melaleuca sieberi* P.; Capalaba, Qld., X-5-58, *Melaleuca sieberi*; Tibrogargan, near Beerwah, Qld., I-6-59, on *Baekia*; Noosa, Qld., IV-5-59, on *Leucopogon margarodes*.

Trigonia carbonaria Smith

Caboolture, Qld., I-6-59, on *Eucalyptus tessellaris* P.; Beerwah, Qld., I-6-59, on *Persoonia virgata*; Beerwah, Qld., VIII-29-58, on *Pultenaea villosa* P.; Ipswich, Qld., IX-4-58, on *Pultenaea villosa* P. C.; Capalaba, Qld., IX-6-58, on *Hibbertia linearis*; Ipswich, Qld., IX-9-58, on *Pultenaea villosa* P. C., on *Daviesia squarrosa*, on *Leptospermum microcarpum*, on *Jacksonia scoparia*, and on *Ageratum houstonianum*; Brisbane, Qld., IX-10-58, on *Pultenaea villosa*; Capalaba, Qld., IX-15-58, on *Hibbertia linearis* and *Leptospermum flavescens*; Capalaba, Qld., IX-20-58, on *Melaleuca sieberi*; Ipswich, Qld., IX-28-58, on *Eucalyptus tereticornis*; Mt. Edwards, Qld., IX-29-58, on *Jacksonia scoparia*; Capalaba, Qld., X-5-58, on *Callistemon salignus*; Mt. Glorious, Qld., X-9-58, on *Rubus rosae-folius* P. and on *Oxylobium ilicifolium* P.; Moggill, Qld., X-19-58, on *Callistemon viminalis*; Beerwah, Qld., X-25-58, on *Xanthorrhoea* P. and on *Podolepis neglecta* P.; Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Moggill, Qld., XI-13-58, *Melaleuca bracteata* P.; Beenleigh, Qld., XI-22-58, on *Nymphaea capensis* P.; Beerwah, Qld., XI-24-58, on *Melastoma polyanthum*; Lamington Natl. Park, XII-7-58, *Claoxylon australe* P.; Tamborine, Qld., XII-18-58, on *Angophora intermedia* P.; Brisbane, Qld., XII-28-58, on *Eucalyptus tessellaris*; Moggill, Qld., XII-28-58, on *Angophora subvelutina*; Capalaba, Qld., XII-27-58, on *Angophora woodsiana* P.;

Moggill, Qld., I-7-59, on *Eucalyptus intermedia*; Ipswich, Qld., I-7-59, on *Eucalyptus intermedia*; Brisbane, Qld., I-10-59, on *Jacksonia scoparia* P. C.; Beerwah, Qld., II-17-59, on *Persoonia virgata*; Noosa, Qld., IV-5-59, on *Banksia*.

Trigona australis Friese

Tamborine, Qld., III-22-59, on *Alphitonia excelsa*; 13 miles south of Warwick, Qld., XII-29-58, on *Eucalyptus crebra* P.; Tamborine, Qld.,

XII-18-58, on *Angophora intermedia* P.; Ipswich, Qld., IX-28-58 on *Eucalyptus tereticornis*; Warwick, Qld., X-1-58, on *Eucalyptus* and *Rapistrum rugosum*; Capalaba, Qld., X-5-58, on *Callistemon salignus*; Moggill, Qld., X-19-58, on *Callistemon viminalis*; Dalby, Qld., X-20-58, on *Swainsona galegifolia*; 17 miles south of Dalby, Qld., X-20-58, on *Wahlenbergia*; Jimboomba, Qld., X-31-58, on *Melaleuca linariifolia*; Mutdapilly, Qld., XI-9-58, on *Melaleuca irbyana* P. C.

APPENDIX 2. DESCRIPTIONS OF NEW SPECIES AND OTHER DESCRIPTIVE DATA

THIS APPENDIX CONSISTS primarily of descriptions of new species, although a few other taxonomic details are included. As explained elsewhere, very many more new species exist. Only those few are described here that (1) constitute new genera or subgenera, or (2) are so distinctive morphologically that reference needs to be made to them even though they do not seem to represent new genera or subgenera, or (3) are from areas where their group was hitherto unknown, or (4) have habits so distinctive that reference was made to them in the text. In brief, when a name was needed for a new species it was provided; elsewhere the new species remain undescribed, and I hope that generic revisions will be made by others and the species described in connection with them.

Leioproctus (Leioproctus) lanhami, new species

Text figures 65-67

This is the second known member of the group of Australian Colletinae from New Guinea. The first, *L. (L.) papuana*, is larger, more robust, with the metasoma dark metallic blue. *Leioproctus lanhami* is a small, slender, nonmetallic species, with a body form like that of *L. (L.) abnormis*, not quite so slender as in most species of the subgenus *Euryglossidia*.

MALE: Length, 6.0 mm. (varying to 6.5 mm.); forewing length, 4.5 mm. Relative head measurements: width, 10.5; length, 8.4; clypeal length, 2.6; clypeo-antennal distance, 0.8; lower interocular distance, 4.8; upper interocular distance, 5.6. Eyes large, so that face is correspondingly narrow, genal area less than one-third as wide as eye seen from side; inner orbits converging below except for upper thirds which converge slightly above; apex of clypeus broadly truncate, end of truncation indicated by distinct angle; preapical thickening of clypeus strong, so that lower part of clypeus is protuberant but not extending much below lower ends of eyes, preapical thickening forming crescentic carina, median part of which overhangs apex of clypeus; clypeal surface in profile almost flat, with broad concavity extending from pre-

apical carina upward onto supraclypeal area; antennae at about middle of face; interocular distance subequal to ocellocular distance, greater than ocelloccipital distance; facial fovea perhaps represented by small, dull, finely and sparsely punctate area that is not sharply defined; scape not closely approaching median ocellus; first flagellar segment much broader than long, second about as long as broad, third and following about 1.5 times as long as broad or a little longer, only the last more than twice as long as broad; metanotum virtually simple, with feeble median subapical elevation; propodeum with horizontal basal zone much longer than metanotum, curving onto vertical surface; mid tibial spine large, flattened, distinct; venation similar to that illustrated for *unguidentatus* but free part of marginal cell more attenuate, longer than rest of cell, apex of marginal cell with long appendage; stigma about two-thirds as long as costal margin of marginal cell; second recurrent vein (usually) slightly basal to third transverse cubital. Punctuation of clypeus coarse and irregular, ground finely roughened and rather dull except for shiny but minutely roughened and largely impunctate longitudinal median concavity; supraclypeal area largely shiny, minutely roughened, impunctate; rest of head more finely punctate, punctures separated by a little minutely roughened ground, large shiny and scarcely punctate area between eye and ocelli, dull and finely punctate area along upper part of inner orbit; thorax shiny, minutely roughened, punctures mostly separated by about a puncture width on discs of major sclerites, posterior face of propodeum quite highly polished, sides of propodeum dull, without noticeable punctures, metepisterna not striate; metasoma strongly shiny, minutely roughened, punctures minute and inconspicuous. Color black; mandible red except base; flagellum very dark brown (not paler beneath), tegula transparent testaceous; pronotal lobe brownish; tarsi, tibiae, and apices of femora yellowish brown; wings slightly grayish, with veins and stigma dark brown; metasoma brownish black, tergal

margins translucent but not pale. (In a few paratypes there are varying amounts of red on the metasomal segments, in some cases confined to basal segments; in its extreme development whole metasoma is red except large roundish black spot at side of second tergum and infuscations at sides of other terga, especially first.) Pubescence whitish, ochraceous on dorsum of head and thorax and on tibiae and tarsi, very short and sparse on dorsum of metasoma, dense, nearly covering surface, on lower part of paraocular area but not on clypeus.

FEMALE: Length, 6 mm.; forewing length, about 4.75 mm. Relative head measurements: width, 11.4; length, 9.5; clypeal length, 3.0; clypeo-antennal distance, 0.9; lower interocular distance, 6.5; upper interocular distance, 6.4. Agrees with description of male except as follows: Eyes less swollen, genal area more than one-third as wide as eye seen from side; upper thirds of eyes converging strongly above; preapical thickening of clypeus as in male but even stronger and more strongly carinate; concavity of clypeal surface shallower; interocellar distance greater than ocellocular distance; first and third flagellar segments slightly broader than long, second much broader than long, fourth to ninth about as long as broad, tenth longer than broad; middle tibia without apical spine; inner hind tibial spur pectinate with only three long teeth. Median concavity of clypeus scarcely smoother and more shining than rest of clypeus; supraclypeal area rather dull and roughened; area between ocelli and eye mostly dull but not or scarcely punctate. Flagellum dark brown beneath, brownish black above; legs brownish black; metasoma black, with posterior margins of terga broadly brownish. Pubescence with fuscous or blackish hairs on vertex, scutum, scutellum, dorsum of first five terga (but very short on first four), and outer sides of middle and hind tibiae and tarsi; prepygidial fimbria and hairs of sixth tergum ochraceous; lower parts of paraocular areas more densely hairy than clypeus but less so than in male.

TYPE MATERIAL: Holotype male, Nadzab (west of Lae), northeast New Guinea, September 10, 1944 (U. N. Lanham), in the Zoological Museum, University of Michigan. Allotype female, same data but September 1,

1944. Fifty-five male paratypes, same data as holotype; one, same data as allotype, one, same data but August 28, 1944, and one, same data but July 23, 1944; in the collections of the University of Michigan; the British Museum, the Commonwealth Scientific and Industrial Research Organization, and the University of Kansas.

The species is named for the collector, now at the University of Colorado, who has done interesting work on *Andrena* and other bees.

***Leioproctus (Leioproctus) megachalcoides*,
new species**

Plate 1, figure 3; text figures 33, 48

This species is superficially similar to *L. (Nodocolletes) megachalceus*, from which it differs by the absence of the metanotal and propodeal characters of the subgenus *Nodocolletes*. It does, however, have a slender stigma as in *Nodocolletes*. An unusual feature is that the second submarginal cell is longer than the third. This species is one of the largest species of the subgenus, with bright green coloration partially obscured by pubescence.

FEMALE: Length, 17 mm. (varying to 13 mm. among paratypes); wing length, 11 mm. (varying to 10 mm. among paratypes). Relative head measurements: width, 10.1; length, 7.6; clypeal length, 2.7; clypeo-antennal distance, 0.8; lower interocular distance, 6.8; upper interocular distance, 6.7. Inner orbits weakly converging below except for upper fourths which converge above; apex of clypeus truncate, angle at end of truncation distinct; surface of clypeus flat and not protuberant in profile; median portion broadly and weakly concave; antennal bases near middle of face, slightly below middles of eyes; interocellar distance considerably less than ocellocular distance, subequal to ocelloccipital distance; scape reaching beyond upper edge of median ocellus; second flagellar segment as long as broad, others longer than broad; metanotum simple; propodeum with steeply sloping basal zone about as long as metanotum, rounding gradually onto subvertical surface of propodeum. Clypeus strongly punctured, punctures separated by about half of a puncture width of shiny ground, apex of clypeus with some larger smooth areas and scattered very coarse

punctures; frons, supraclypeal area, lower part of paraocular area, and middle of vertex behind ocelli with punctures somewhat finer than those of clypeus; rest of head with much finer sparse punctures on minutely roughened ground, scutum, scutellum, and mesepisternum with punctures coarser than those of frons, separated by more than a puncture width of smooth ground except marginally on scutum and scutellum, anterior part of scutellum largely impunctate, posterior median part of scutum with large, sparsely punctate area; mesepisternum with punctures coarser and closer, ground minutely roughened, lower parts strigose-punctate; metepisternum not striate; propodeum dull, with only fine widely separated punctures, absent on triangle; metasoma, except for shiny basal concavity of first tergum, dull dorsally, first and fifth terga with rather coarse, widely separated punctures like those of scutum, other terga with small, closer punctures; posterior margins of terga broadly dull and impunctate; venter of metasoma more shiny, punctate on minutely roughened ground. Color a strong blue-green; mandible black, greenish only basally; clypeus and supraclypeal area black medially; broad black patch mesial to upper part of eye may represent facial fovea; antenna black, under side of flagellum dark brownish apically; tegula translucent brown; legs black, with greenish color out to and including tibiae; apical margins of metasomal terga bronzy. Pubescence white, ochraceous dorsally, that of the following areas black or fuscous: vertex, scutum and scutellum except margins (discs largely bare), much of axilla, area behind pronotal lobe and beneath wing base, tibiae and tarsi (except that scopa on under side of hind tibia is white), apical part of prepygidial fringe, and sixth tergum and sternum; metasomal terga rather densely covered with short, erect, ochraceous hair, longer and recumbent subapically but not forming fasciae.

TYPE MATERIAL: Holotype female, Mullewa, Western Australia, September (L. J. Newman), in the Western Australian Museum. One female paratype, same data, in the Snow Entomological Museum of the University of Kansas. Two female paratypes, Dongarra, Western Australia, September 26

to October 3, 1935 (R. E. Turner), in the British Museum (Natural History).

The specific name indicates the superficial resemblance to *L. megachalceus*.

***Leioproctus (Leioproctus) unguidentatus*,
new species**

Plate 1, figure 4; text figures 32, 60

This species is a member of the group of *L. platycephalus*, having the small, robust form of *L. truncatulus*, but differs from most species of the group in having a dark blue rather than a red metasoma. The most interesting character of the species, however, is the small inner tooth of each claw of the female; the claws are therefore intermediate between the simple ones of the more extreme members of the group such as *platycephalus* and *truncatulus* and the cleft ones of *maculatus*, *rubellus*, and most other species of *Leioproctus*, *sensu stricto*.

FEMALE: Length, 7 mm.; wing length, 6 mm. Relative measurements of head: width, 15.0; length, 12.1; clypeal length, 4.5; clypeo-antennal distance, 1.4; lower interocular distance, 8.8; upper interocular distance, 8.6. Inner orbits converging below except for upper thirds (or less) which converge strongly above; apex of clypeus broadly rounded, more strongly sublaterally marking end of "truncation"; surface of clypeus slightly convex in profile; antennal bases at middle of face, slightly below middle of eye; interocular distance equal to ocellular distance, about twice ocellocipital distance; facial fovea perhaps represented by sparsely punctate area; scape reaching upper edge of anterior ocellus; first and third flagellar segments about as broad as long, second broader than long, others longer than broad; metanotum simple; propodeum with horizontal basal area as long as metanotum, set off by carina from vertical surface of propodeum, three or four weak, irregularly spaced, longitudinal carinae running length of basal area; basitibial plate one-third as long as tibia; claws each with small inner tooth slightly beyond middle; venation as shown in figure 32. Clypeus and lowest extremity of paraocular area shining with scattered coarse punctures; supraclypeal area shining, almost impunctate; rest of body minutely roughened, dull on head and thorax,

somewhat shining on metasoma, with punctures which are shallow, poorly defined, mostly separated by several puncture widths, coarsest on scutellum, very small and widely separated on metasomal terga, absent from propodeal triangle and broad tergal margins; metepisterna rather weakly transversely striate; genal area and upper part of frons vaguely vertically striate. Color black, under side of flagellum dark brown; metasomal terga dark blue; wings dusky, veins and stigma dark brown. Pubescence of venter and sides of body and of coxae, trochanters, and femora whitish; hair of whole propodeum and basal declivity of first metasomal tergum whitish; hair of face fuscous, with whitish intermixed in middle of face; hair of vertex, scutum, scutellum, metanotum, tegula, and dorsum of metasoma (very short and sparse on dorsal surfaces of first four terga) black; fifth and sixth metasomal sterna black haired; black hairs intermixed on pronotal lobes and upper parts of mesepisterna; tibiae and tarsi with fuscous hairs, black on outer sides of mid and hind tibiae, reddish on under sides of tarsi; tibial scopa black on outer side of tibia but white hairs on inner side of hind tibia.

TYPE MATERIAL: Holotype female, Dunwich, north Stradbroke Island, southern Queensland, August 21, 1958 (C. D. Michener), on flowers of *Dillwynia peduncularis*, in the collection of the Commonwealth Scientific and Industrial Research Organization. One paratype female, same data, but taken on August 22, 1958, by F. A. Perkins, in the Snow Entomological Museum of the University of Kansas.

The specific name refers to the toothed claws; they are neither cleft as in most species nor simple as in a few, but are intermediate.

***Leioproctus (Microcolletes) finkei*, new species**

Plate 1, figure 11

This species is similar to *L. microsomus*, as shown by the low antennal bases, the structure of the metanotum and propodeum, and many other features, but differs by the uniformly punctate and unexcavated clypeus and supraclypeal area, the partially or wholly red metasoma with less conspicuous punctation, the partly red legs, and other features.

FEMALE: Length, 6.5 mm.; forewing length, less than 4.5 mm. Relative head measurements: width, 11.6; length, 9.7; clypeal length, 3.0; clypeo-antennal distance, 0.6; lower interocular distance, 7.0; upper interocular distance, 7.5. Agrees with description of *microsomus* except as follows: Clypeal and lower supraclypeal surface gently convex; slanting basal part of propodeum nearly as long as metanotum. Clypeus, supraclypeal area, and frons punctate (except for apical part of clypeus), punctures considerably finer than in *microsomus*; scutum punctured about like lateral part of frons, not strikingly more finely so laterally as in *microsomus*; scutellum and mesepisternum more coarsely punctate; propodeum with large smooth areas, triangle smooth in all specimens; metasoma minutely roughened but rather shiny, punctures of terga finer, inconspicuous (although more distinct than in *wahlenbergiae*). Mandible red; flagellum brown, entire under side light brown; tegula translucent testaceous; legs red, infuscated on femora, trochanters, coxae, and outer sides of tibiae; metasoma black, apical margins of terga and sterna broadly brown, first two terga dark red, large roundish black spot at side of second tergum (varying among paratypes to metasoma wholly red except for spot at side of second tergum). Pubescence fuscous only around basitibial and pygidial plates.

TYPE MATERIAL: Holotype female, Finke Crossing, central Australia, 1933 (J. W. Rose), in the collection of the Commonwealth Scientific and Industrial Research Organization. Three female paratypes, same data. Three female paratypes, Finke River, central Australia (J. W. Rose). The paratypes are in the collection of the Commonwealth Scientific and Industrial Research Organization and the Snow Entomological Museum of the University of Kansas.

The Finke River rises in southern Northern Territory and crosses into South Australia.

***Leioproctus (Microcolletes) microsomus*,
new species**

Plate 1, figure 10

This species resembles *L. finkei* in its small size and the low position of the antennae on the face, but differs from that species in the more distinctly punctate metasoma, the lack

of red on the metasoma, the medially concave clypeal surface, and other characters.

FEMALE: Length, nearly 7 mm.; forewing length, 4.5 mm. Relative head measurements: width, 12.3; length, 9.1; clypeal length, 2.8; clypeo-antennal distance, 0.5; lower interocular distance, 7.4; upper interocular distance, 7.9. Inner orbits converging below except for upper parts which converge above; apex of clypeus broadly truncate, with distinct angle at end of truncation; surface of clypeus flat in profile, surface except at lower margin broadly concave, lower part of supraclypeal area slightly concave; antennal bases below middle of face, upper edge of antennal socket below middle of eye; interocular distance slightly greater than ocellocular distance, much greater than ocelloccipital distance; facial fovea absent; first flagellar segment slightly broader than long, second and third more than twice as broad as long, fourth twice as broad as long, all but last broader than long; metanotum very feebly elevated medially; propodeum with basal part steeply slanting, much shorter than metanotum, rounding onto vertical surface; jugal lobe of hind wing considerably exceeding cu-v. Punctures of clypeus rather large, separated by shiny ground, longitudinal median concave area of clypeus impunctate and shiny along median axis, most of supraclypeal area impunctate and shiny; rest of head more finely punctate than clypeus, punctures rather close except for nearly impunctate broad band from supraclypeal area to vicinity of ocelli and sparsely punctate area lateral to ocelli; mesepisternum, scutellum, and posterior central part of scutum punctured about like lateral part of frons, rest of scutum gradually more finely and closely punctate; propodeum minutely roughened, triangle smooth (or in paratypes, to varying extent, minutely roughened but shining); metasomal terga and sterna distinctly punctured (coarser on sterna), punctures separated by about a puncture width of dull ground (first, and in some cases second, tergum quite shiny), third and fourth terga with punctures rather small and inconspicuous on dull ground; posterior margins of terga broadly somewhat depressed, minutely roughened, impunctate, sternal margins more narrowly impunctate. Color black, mandibu-

lar apices reddish, flagellum with fourth and following segments light brown beneath, third with small brown spot, upper surface of flagellum dark brown apically; tegula dark brown; apices of metasomal terga and sterna brownish; wings nearly clear, veins and stigma brown. Pubescence dull whitish, light fuscous and ochraceous on dorsum of thorax, on vertex, on outer sides of fore and middle tibiae, around basitibial plate, and at apex of metasoma (prepygidial fimbria and on sixth tergum); hairs very short although abundant on scutum; no metasomal hair bands; hair of sterna long, coarsely plumose.

MALE: Length, 5.5 mm.; wing length, about 4.3 mm. Relative head measurements: width, 11.5; length, 9.0; clypeal length, 2.7; clypeo-antennal distance, 0.6; lower interocular distance, 6.2; upper interocular distance, 7.2. Agrees with description of female except as follows: Concavity of clypeus and supraclypeal area less striking than in female, perhaps merely flat; antennal bases little below middle of face; first flagellar segment much broader than long, second more than three times as broad as long, third about three times, fourth twice as broad as long, all others distinctly broader than long except last; metanotum not elevated. Punctures of clypeus similar to those of lower paraocular area, no impunctate median zone on clypeus but supraclypeal area and zone extending to ocelli largely impunctate; punctures of head more widely separated than in female, mostly separated by somewhat less than a puncture width; scutum with punctures well separated by shining ground, not fine nor rather close marginally. Apices of tarsi brown. Pubescence longer than in female, whitish, not short on scutum; conspicuous apical fringe on fifth sternum.

TYPE MATERIAL: Holotype female and allotype male, 17 miles south of Dalby, southern Queensland, October 20, 1958 (C. D. Michener), in the collection of the Commonwealth Scientific and Industrial Research Organization. One female and 10 male paratypes, same data. One female paratype, Jondaryan, southern Queensland, October 20, 1958 (C. D. Michener). All specimens were on flowers of *Wahlenbergia*. The paratypes will be placed in the collections of the following institutions: Commonwealth Scientific

and Industrial Research Organization, the British Museum, the University of Kansas, and the Queensland Museum.

The specific name refers to the small body size.

***Leioproctus (Microcolletes) wahlenbergiae*,
new species**

Plate 1, figures 8, 9; text figures 96-98

This species differs from most species of the subgenus in the fine, granular metasomal terga on which the punctures are scarcely recognizable. This is almost the situation, also, in *finkei*, a species that differs from *wahlenbergiae* in the shining rather than dull propodeal triangle, smaller size, and other features.

FEMALE: Length, 8 mm.; forewing length, 5 mm. Relative head measurements: width, 13.3; length, 10.3; clypeal length, 3.4; clypeo-antennal distance, 1.0; lower interocular distance, 7.9; upper interocular distance, 9.2. Inner orbits converging below except for upper fourths which are subparallel; apex of clypeus broadly truncate, with distinct angle marking end of truncation; surface of clypeus nearly flat in profile, not excavated medially; antennal bases at middle of face; upper margin of antennal socket about middle of length of eye; interocellar distance equal to ocellocular distance and much greater than ocellocapital distance; facial fovea absent, perhaps represented by sparsely punctate area; first flagellar segment about as long as broad, about as long as second and third together which are over twice as broad as long; middle (and penultimate) flagellar segments slightly broader than long; metanotum slightly elevated posteromedially; propodeum with basal sloping area shorter than metanotum, rounding onto vertical surface; jugal lobe of hind wing slightly exceeding cu-v. Head strongly and closely punctate except for largely impunctate and shining supraclypeal area and more sparsely punctate areas at side of frons and between eye and ocelli; clypeus most coarsely punctate; scutum, scutellum, and mesepisternum with punctures coarser than those of vertex and slightly finer than those of clypeus, separated by about a puncture width of shining ground (less around margins of dorsal sclerites, especially front of scutum)

which is minutely roughened on mesepisternum; metepisternum and propodeum minutely roughened, propodeum (including triangle) rather dull; metasomal terga and sterna dull, minutely granular, punctation not evident except for shining anterior surface of first tergum. Color black, mandible reddish apically; flagellum light brown beneath except for first segment, only small brown areas on second and third, last flagellar segment also brown above; tegula translucent brown; last tarsal segments brownish; apices of metasomal terga broadly light translucent brown; sterna narrowly so; wings clear, veins and stigma brown. Pubescence dull whitish, rather sparse, slightly ochraceous dorsally, on outer sides of fore and mid tibiae, on tarsi, and at apex of metasoma, not forming metasomal bands; white fringe on fifth sternum.

MALE: Length, 8 mm.; forewing length, 5 mm. Relative head measurements: width, 13.3; length, 10.0; clypeal length, 3.3; clypeo-antennal distance, 1.0; lower interocular distance, 7.0; upper interocular distance, 9.2. Similar to description of female except as follows: Inner orbits converging throughout; metanotal elevation scarcely evident. Impunctate part of supraclypeal area smaller, limited to lower part; clypeus not more coarsely punctate than rest of face. Second flagellar segment completely black. Pubescence longer and denser, especially on lower half of face; apical fringes on fourth and fifth sterna.

TYPE MATERIAL: Holotype female and allotype male, 17 miles south of Dalby, Queensland, October 20, 1958 (C. D. Michener), in the collection of the Commonwealth Scientific and Industrial Research Organization. Four female and 25 male paratypes, same data. One female and five male paratypes, Jondaryan, Queensland, October 20, 1958 (C. D. Michener). All specimens were taken on flowers on *Wahlenbergia*. The paratypes will be placed in the collections of the following institutions: Commonwealth Scientific and Industrial Research Organization, the British Museum, the University of Kansas, and the Queensland Museum.

The specific name refers to the occurrence of this bee on flowers of *Wahlenbergia*.

***Leioproctus (Excolletes) impatellatus*,**
new species

Plate 1, figure 12; plate 2, figure 1;
text figures 37, 51, 102-104, 108

This is a small black species superficially resembling some species of *Leioproctus* (*Microcolletes*) such as *L. halictomimus* but much more finely and sparsely punctate, and with numerous differences, the most striking of which are italicized in the subgeneric description.

FEMALE: Length, 8 mm.; forewing length, 4.5 mm. Relative head measurements: width, 14.5; length, 11.5; clypeal length, 3.0; clypeo-antennal distance, 0.5; lower interocular distance, 8.1; upper interocular distance, 9.4. Inner orbits converging below except for upper thirds which converge above; apex of clypeus weakly and broadly emarginate medially, angle marking end of truncation rounded; surface of clypeus weakly depressed medially, only weakly convex in profile; interocellar distance about 1.5 times ocellocular distance and more than twice ocellocipital distance; first flagellar segment slightly longer than broad, last distinctly so, second and third much broader than long, fourth to ninth progressively less so, and tenth about as broad as long; median length of metanotum less than half of that of scutellum and about equal to that of subhorizontal zone of propodeum. Clypeus shining, punctures large and irregularly spaced, especially apically; rest of head finely punctured, punctures of lower part of frons, lower paraocular areas, and lower genal areas distinct and separated by about a puncture width of shining ground, becoming smaller and inconspicuous in mostly minutely roughened ground on vertex; scutum and scutellum largely nearly impunctate (with only a few scattered small punctures), ground minutely roughened but shining, anterior third of scutum and margins of both sclerites with punctures denser; mesepisternum shining with scattered punctures; metepisternum shining, not striate; propodeum with only very fine, well-separated punctures posteriorly and laterally, triangle shining but minutely roughened, impunctate; metasoma minutely roughened but shining, the small punctures not conspicuous. Color black, mandible red subapically, under side

of flagellum light brown, tegula translucent testaceous, distal parts of tarsi brownish, tibial spurs testaceous, under side of metasoma dark brown, apices of metasomal terga brownish translucent; wings nearly clear, veins and stigma light brown. Pubescence rather long, very sparse on disc of clypeus and not forming fringe overhanging margin, absent or nearly so on impunctate parts of scutum and scutellum; color dull whitish, slightly yellowish on dorsum, with fuscous hairs intermixed on vertex and dorsum of thorax, hairs of tibiae and tarsi yellowish, some fuscous hairs on outer side of tibiae; hind tibia with hairs of base, on outer surface (where basitibial plate would be) black, grading into white before middle of tibia; metasoma with hairs of first tergum whitish, those of second to sixth fuscous (or black), moderately long and erect, appressed white hairs forming apical fasciae (weak medially) on terga 2 to 4; hairs of metasomal venter whitish.

MALE: Length, 5.5 mm.; forewing length, 3.5 mm. Relative head measurements: width, 11.3; length, 9.0; clypeal length, 3.0; clypeo-antennal distance, 0.5; lower interocular distance, 5.4; upper interocular distance 7.5. Similar to description of female except as follows: upper parts of inner orbits subparallel; apex of clypeus not emarginate, surface not depressed medially; interocellar distance nearly twice ocellocular distance; first flagellar segment much broader than long, second slightly so, third to tenth about as broad as long, eleventh much longer. Punctures of clypeus finer, more uniform, and denser than in female, slightly finer and denser than those of frons; punctures of paraocular area fine and sparse, punctures of rest of body a little coarser and more numerous than in female. Antennal flagellum dark brown above, testaceous beneath; legs dark brown, tarsi light brown. Pubescence of lower part of face denser than in female, no bare area on clypeus; dorsal pubescence scarcely yellowish; no fuscous hairs, longer erect hairs of metasomal terga grayish; appressed whitish hairs of tergal margins not dense enough to form bands.

TYPE MATERIAL: Holotype female, allotype male, and one female and one male

paratype, 95 miles north of Tibooburra, New South Wales, November 3, 1949 (S. J. Paramonov), in the collection of the Commonwealth Scientific and Industrial Research Organization. Two female and two male paratypes, Clifton Downs, New South Wales, October 31, 1949 (J. S. Paramonov), in the collection of the Commonwealth Scientific and Industrial Research Organization.

The specific name refers to the lack of basitibial plates or "patellae."

Leioproctus (Colletopsis) contrarius,
new species

Plate 2, figure 2; text figures 42, 54

This slender black species with a relatively large head and dusky wings is quite different in appearance from any others. The striking contrast between the coarsely punctate head and the finely punctate scutum is a noteworthy feature, as are the various characters enumerated in the description of the subgenus.

FEMALE: Length, 10 mm.; forewing length, 7 mm. Relative head measurements: width, 17.0; length, 15.4; clypeal length, 6.1; clypeo-antennal distance, 1.0; lower interocular distance, 9.7; upper interocular distance, 12.0. Inner orbits converging below, upper thirds subparallel; clypeus produced well below lower ends of eyes, apex truncate, end of truncation rounded, profile of clypeus convex, protuberant, in front of anterior eye margin by distance almost equal to eye width in side view; facial fovea about twice as long as broad; interocular distance slightly greater than ocellocular distance, much greater than ocellocapital distance; first and last flagellar segments longer than broad, second and third about twice as broad as long, fourth to ninth progressively longer but all broader than long; median length of metanotum less than half of that of scutellum. Head coarsely punctate, most finely and closely so on genal areas where punctures are close, elsewhere punctures separated by less than a puncture width of shiny ground, coarsest on disc of clypeus; clypeus with longitudinal median impunctate band; supraclypeal area with high, impunctate, shining ridge; facial fovea dull, impunctate; mesepisternum coarsely

punctate, about like frons, hypoepimeral area largely shining and impunctate; scutum, scutellum, and metanotum relatively finely punctate, punctures separated by much less than a puncture width; dorsolateral parts of propodeum large and convex because of relatively small triangle, coarsely punctate, like vertex; sides of propodeum more finely punctate; triangle minutely lineolate in some areas, margined laterally by row of small pits; metasomal terga with coarse punctures (almost as large as those of vertex) separated by more than a puncture width, ground between them with minute punctures, the latter absent on posterior marginal parts of terga where large punctures are closer, extreme margins (and broad margin on fourth) impunctate; sterna with widely separated coarse punctures on minutely roughened ground. Color black; mandibles reddish subapically; flagellum brown beneath; tegula brown; femora, tibiae, and metasomal sterna largely dark brown; posterior margins of terga translucent brown; wings strongly brown, veins and stigma nearly black. Pubescence sparse, short, dull whitish, that of vertex reddish brown, coarse, simple; that of frons paler, coarse, simple, blunt-tipped, upcurved; that of clypeus shorter, directed downward, simple except laterally; pubescence of scutum and scutellum excessively short (shorter than diameter of larger wing veins and as short as hairs on wings), light brown; hairs on first four metasomal terga very short and sparse, pale, at extreme sides forming distinct white apical hair patches not noticeable in dorsal view; apex of fifth sternum with long dense fringe of yellowish hair; sixth sternum with sparse yellowish hair; fifth and sixth terga with long dense fuscous hair.

TYPE MATERIAL: Holotype female, Bullsbrook, Western Australia, 54-55 (A. W. Douglas), in the Western Australian Museum; Mr. Douglas tells me that this specimen was taken on December 28, 1954. One female paratype, Forrestdale, Western Australia, 55-448, November 25, 1952 (R. P. McMillan), in the Western Australian Museum.

The specific name refers to the contrasting punctuation of various parts of the body, especially the head and the thorax.

***Leioproctus (Urocolletes) rhodurus*, new species**

Plate 2, figure 3; text figures 40, 53

This species is superficially similar to *L. (Anacolletes) callurus*, being dark, with the hair of the last two metasomal segments fulvous, but differs in its larger size, the lack of arolia, the smooth propodeal triangle, and many other features.

FEMALE: Length, nearly 12 mm.; forewing length, 7 mm. Relative measurements of head: width, 8.0; length, 6.0; clypeal length, 2.0; clypeo-antennal distance, 0.9; lower interocular distance, 4.5; upper interocular distance, 5.3. Inner orbits converging below, upper thirds subparallel; apex of clypeus truncate, with distinct angle at end of truncation; epistomal suture distinct; interocellar, ocellocular, and ocelloccipital distances subequal; first and last flagellar segments longer than broad, others broader than long, second and third shortest and others progressively longer; median length of metanotum about two-thirds of that of scutellum because of median projection which is flat on top, rounded apically. Punctures rather close, those of clypeus coarse, of vertex rather fine, of rest of head intermediate; scutal punctures much finer than those of head and most of thorax, scutellum with punctures about the size of those of vertex, mesepisternum with coarser punctures about like those of supraclypeal area; metanotum granular; propodeal triangle smooth, some small pits along lateral margin; metasomal terga with punctures about as coarse as those of frons, slightly finer on posterior marginal areas, only narrow margins impunctate. Color black, with faint dark blue tint on frons, vertex, and scutum; mandibles red preapically; flagellum brown beneath; tegula, legs, and under side of metasoma dark brown; metasomal terga brownish apically, basal terga brownish throughout; wings grayish, veins and stigma dark brown. Pubescence of head whitish except on vertex where it is black; some black intermixed on clypeus, supraclypeal area, and along inner orbits; hairs of scape black; hair of thorax white, that of scutum (except anterior margin), scutellum (except laterally), dorsomedian part of metanotum, tegula, and small area

behind pronotal lobe black; hair of tibiae, tarsi, and dorsal apices of femora black or fuscous, some white hairs from under side of hind tibia forming anterior part of scopa; first two metasomal terga and first four sterna with hairs whitish; third and fourth terga with hairs fuscous or black, white at extreme sides; fifth and sixth segments with hair long, dense, and bright fulvous.

TYPE MATERIAL: Holotype female, Midland, Western Australia, 37-3797, in the Western Australian Museum. The specimen was taken by Mr. A. Douglas who writes that it was captured on flowers of *Leptospermum* on February 14, 1937.

The specific name refers to the red hair on the apex of the metasoma.

***Leioproctus (Glossurocolletes) bilobatus*, new species**

Plate 2, figure 7; text figures 112-115

Although obviously related to *L. xenocerata*, this species differs by a number of striking features which are italicized below.

MALE: Length, 7.5 mm.; forewing length, 4.5 mm. Relative head measurements: width, 14.6; length, 11.8; clypeal length, 3.2; clypeo-antennal distance, 1.8; lower interocular distance, 7.0; upper interocular distance, 9.4. Inner orbits converging below except for upper subparallel thirds; facial fovea about as wide as ocellus; apex of clypeus truncate, distinct although rounded angle at end of truncation; *epistomal suture almost invisible medially*, below lower end of supraclypeal ridge, *summit of clypeus only about as wide as antennal socket*; *subantennal sutures converging below, joining epistomal suture at lower end of supraclypeal ridge*; interocellar distance greater than ocellocular distance and nearly twice ocelloccipital distance; *scape little more than twice as long as broad, not reaching middle ocellus*; first flagellar segment broader than long, second and third twice as broad as long, *fourth to eighth broader than long*, ninth to eleventh slightly longer than broad; segments 2 to 8 progressively more flattened beneath, eighth somewhat concave, all of these with short erect hairs beneath; *ninth with deep concavity and apical reflexed ventral flap*; *entire front tarsus broad, flat*, all segments except last expanded laterally and slightly

broad than tibia, last segment less broad; outer margin of tarsus with masses of white plumose hairs somewhat longer than tarsal width arising before bare apices of segments; tooth of hind trochanter blunt, rounded; sixth sternum with small, smooth, longitudinal apical prominence; pygidial plate rather broad, convex, bare, not defined laterally, projecting to rounded apex behind apical margin of tergum. Clypeus irregularly coarsely punctate and shining, with broad, longitudinal, median, finely rugose, dull band; supraclypeal area (except impunctate summit of ridge) and genal area moderately coarsely and closely punctate, frons and vertex more coarsely and rather closely punctate except for large shining impunctate area lateral to lateral ocellus; facial fovea rather dull, not punctate; paraocular area, especially below level of antenna, finely and sparsely punctate; scutum, scutellum, and mesepisternum with punctures similar to those of vertex, those of scutum slightly finer, of mesepisternum slightly coarser; metepisternum dull and weakly transversely striate; sides of propodeum finely and rather closely punctate; propodeal triangle shining and impunctate, minutely roughened laterally; metasomal terga with punctures about as coarse as those of sides of propodeum, punctures almost reaching apices of terga. Color black, mandible yellowish brown, red apically; flagellum black at base but progressively lighter brown toward apex; tegula brown, infuscated anteriorly and medially; apices of femora, bases and apices of tibiae, apices of basitarsi, mediotarsal segments, and posterior margins of anterior and middle basitarsi yellowish brown; wings grayish, veins and stigma brownish black, apical margins of terga brownish. Pubescence whitish, brown or fuscous on vertex, disc of scutum, and disc of scutellum; metasoma with whitish pubescence on first tergum and dorsum of others with short fuscous or blackish pubescence; third to fifth sternum with long, dull whitish, apical fringes.

TYPE MATERIAL: Holotype male, Stirling Range, Western Australia, November 19, 1958 (E. F. Riek), in the collection of the Commonwealth Scientific and Industrial Research Organization.

The specific name refers to the deeply bilobed eighth metasomal sternum.

Leioproctus (Glossurocolletes) xenoceratus,
new species

Plate 2, figure 6; text figures 41, 116

The most striking characters by which this species differs from its relative, *bilobatus*, are italicized in the description.

MALE: Length, 7.5 mm.; wing length, almost 5 mm. Relative head measurements; width, 15.7; length, 12.0; clypeal length, 3.7; clypeo-antennal distance, 1.0; lower interocular distance, 7.5; upper interocular distance, 9.0 (approximately). Inner orbits converging below except for upper parallel thirds; facial fovea wider than ocellus; clypeal apex truncate, distinct although rounded angle at end of truncation; *epistomal suture visible, summit of clypeus about twice as wide as antennal socket; subantennal sutures distinct, diverging below, extending to tentorial pits rather than joining epistomal suture at usual points; interocellar distance scarcely greater than ocellocular distance, distinctly greater than ocelloccipital distance; scape curved, nearly four times as long as wide; first flagellar segment about as broad as long, second and third more than twice as broad as long, fourth and fifth broader than long, others longer than broad and progressively more so toward apex; flagellum, especially beyond fourth segment, flattened, ninth to eleventh segments with progressively larger ventral concavities; front tarsus slender, of ordinary form, last segment of front and middle tarsus large; tooth of hind trochanter acute; sixth sternum with long, laterally compressed, bladelike, blunt-tipped, erect apical spine; pygidial plate as in *bilobatus*. Head strongly and closely punctate except longitudinal median irregular impunctate line on clypeus, impunctate summit of supraclypeal ridge, large shining impunctate area mesial to subantennal suture, finely roughened facial fovea, and impunctate area lateral to each lateral ocellus; scutum, scutellum, and mesepisternum with punctures slightly coarser than those of head and slightly separated by shining ground; metepisternum, propodeum, and metasomal punctation about as in *bilobatus*. Coloration as in *bilobatus* but tegula brown; legs brownish black; wing veins and stigma dark brown. Pubescence as in *bilobatus*.*

TYPE MATERIAL: Holotype male, Capel,

Western Australia, November 10, 1940, in the Western Australian Museum.

The specific name refers to the peculiar form of the antennae.

Leioproctus (Nodocolletes) pacificus,
new species

Plate 2, figure 10; text figures 120-122

This is the only species of the genus known from New Caledonia. It differs from other species of the subgenus by its smaller size and especially the very long and apically slender metanotal spine, the total length of the metanotum, including the spine, being about three-fourths as long as the scutellum. In other forms with a single rather long metanotal projection such as *dentiger*, it is thick, blunt, and projects more upward than posteriorly, and the total length of the metanotum, including the projection, is little if any more than half of the length of the scutellum.

MALE: Length, 11 mm.; forewing length, slightly less than 6.5 mm. Relative head measurements: width, 16.0; length, 12.6; clypeal length, 4.3; clypeo-antennal distance, 1.5; lower interocular distance, 8.0; upper interocular distance, 10.1. Eyes strongly converging below except for upper thirds which converge slightly above; facial fovea absent; apex of clypeus broadly rounded, only a weak rounded angle separating median somewhat truncated part of margin from lateral part; supraclypeal area with rather strong median tubercle at lower end of frontal carina; interocellar distance equal to ocellocular distance and much longer than ocelloccipital distance; first flagellar segment broader than long, second scarcely longer than broad; remaining segments slightly more than 1.5 times as long as broad; stigma more than half as long as costal margin of marginal cell; jugal lobe not attaining cu-v; metanotal spine projecting more posteriorly than upward, slender and pointed, smooth, apical quarter hairless; propodeal triangle entirely subvertical in profile; pygidial plate represented by slight bare ridge extending more than half of length of seventh tergum, no carinate or clearly defined margins. Clypeus, supraclypeal area, and frons with strong punctures separated by much less than a puncture width of shining, smooth ground; paraocular areas similarly but somewhat more finely punctate;

vertex more finely punctate, punctures separated by a puncture width or more, large impunctate shining area lateral to each lateral ocellus; genal area and mesepisternum rather dull, minutely roughened, lower parts vertically striate, punctures separated by a puncture width or more, those of mesepisternum as large as those of clypeus, those of genal area finer; scutum and scutellum with punctures finer than those of clypeus, mostly separated by about two puncture widths of shining ground; metepisternum and propodeum minutely roughened, rather dull, propodeal triangle with a few fine, oblique striae basolaterally; metasoma with ground minutely roughened but shining, punctures on terga about as large as those at sides of vertex and separated by one to two puncture widths, margins of terga broadly depressed, with similar punctation on basal half of each depressed area, apical halves impunctate but minutely roughened like rest of ground; sterna with coarser and more scattered punctures. Color metallic blue and green, about as intense as in *caeruleotinctus*; head blue-green, with brassy coloration on frons; genal and hypostomal areas blue; scutum brassy green; rest of thorax blue except that prothorax, metepisternum, and propodeum are nonmetallic black; metasoma blue-green dorsally, apical terga brownish black; sterna dark brown; mandible black, reddened apically; labrum and antenna black; tegula and legs brownish black; wings slightly grayish, veins and stigma brownish black. Pubescence of head ochraceous, whitish beneath, some black or fuscous hairs intermixed below antenna, on lower paraocular area, and on mandible; vertex with hairs fuscous; thorax with hair ochraceous, black on scutum except for anterior transverse band and posterior transverse band that includes axillae; hair of scutellum and dorsum of metanotum including spine black; upper part of mesepisternum with black hair; hair beneath hind wings and on sides of propodeum largely fuscous; hair of legs ochraceous, that of outer sides of tibiae and tarsi and on parts of femora black; metasoma with hair of first tergum whitish, black apically, that of other terga black; sternal hairs ochraceous, those of sixth black, not forming noticeable fringes.

TYPE MATERIAL: Holotype male, Nepoui

Valley, New Caledonia, July, 1940 (F. X. Williams), in the collection of the Hawaiian Sugar Planters Experiment Station, soon to be deposited in the Bernice P. Bishop Museum.

The specific name refers to the insular occurrence of this species, far out in the Pacific Ocean.

Leioproctus (Goniocolletes) dolosus, new species
Plate 3, figures 1, 2; text figures 44, 56, 139–141

Paracolletes subdolosus: RAYMENT, 1949e, p. 33 (misidentification).

Rayment's allotype of *P. subdolosus* Cockrell does not belong to the same species or subgenus as the true *subdolosus*, and is here made the type of a new species. The name *dolosus* was used for the same species by Rayment, but appears never to have been published; it is used here for this distinctive species which has the aspect of a rather large *Leioproctus*, *sensu stricto*, although it clearly belongs to *Goniocolletes*. The rather broad metasoma is suggestive of group *a* in the above list of species; *dolosus* differs from all other members of that group by the black metasoma, which has broadly depressed but not translucent tergal margins. The propodeum is distinctive in that the whole profile is nearly vertical, although there is a distinct carina separating the basal area from the rest of the triangle. In other species the area in front of the carina (if present) is more horizontal.

MALE: Length, 12 mm. (nearly 15 mm. if fully straightened and extended); winglength, 8.5 mm. Relative head measurements: width, 7.6; length, 6.5; clypeal length, 2.3; clypeo-antennal distance, 0.8; lower interocular distance, 4.2; upper interocular distance, 4.5. Inner orbits converging below except for upper thirds which converge above; facial fovea distinctly impressed, widest above, about two-thirds as wide as an ocellus and more than four times as long as wide; apex of clypeus truncate, with distinct angle at end of truncation; interocellar distance distinctly longer than ocellular and ocelloccipital distances; all flagellar segments longer than broad, first and second but little so, middle flagellar segments more than 1.5 times as long as broad; wings with hairs almost throughout, jugal lobe attaining cu-v; basal area of pro-

podal triangle subvertical in profile, set off by a strong transverse carina from vertical surface behind it; legs not noticeably modified, outer hind tibial spur nearly three-fourths as long as inner; pygidial plate large, defined laterally by carina extending halfway from apex to anterior margin of tergum; sixth sternum with longitudinal median black ridge forming blunt tooth in middle of sternum. Face finely and closely punctate except for minutely roughened fovea; rest of head more coarsely and less closely punctate, impunctate shiny area lateral to each lateral ocellus; sides of thorax similarly and scarcely more coarsely punctate; scutum and scutellum somewhat more coarsely punctate, especially on discs where punctures are separated by distinct shiny ground, there being a small area lateral to midline of scutum and anterior area lateral to midline of scutellum where punctures are separated by more than a puncture width; propodeal triangle shining but minutely roughened, usually with secondary transverse carina above and below principal transverse one; metasomal terga strongly punctured, punctures as large as those of vertex but mostly more widely separated; posterior margins of third to sixth terga broadly depressed and with only small scattered punctures; sterna more sparsely punctate in discal areas. Color black, under side of flagellum brown; tegula translucent brown, legs dark brown, with tarsi, apices of tibiae, bases of tibiae, apices of femora, and anterior side of front tibia light yellow-brown; wings nearly clear, slightly darkened apically, veins and stigma brown. Pubescence long and rather dense, that of face shining pale yellow, recumbent, obscuring surface completely; that of genal areas and venter of thorax pale yellow, that of rest of thorax fulvous, that of first four terga long, erect, yellow fulvous, hairs on depressed apical parts of third and especially fourth terga fuscous; fifth to seventh terga with long erect black hairs, yellow fulvous at extreme sides and intermixed basally and laterally on fifth; first sternum and extreme sides of others with long yellowish hairs, otherwise sterna with short sparse pale hairs except for apical fringes of yellow hairs, absent medially and longest laterally, on terga 2 to 4 and midapical tuft of yellow hairs on tergum 6.

FEMALE: (Metasoma beyond third tergum and middle of fourth sternum gone). Length, 14 mm. (estimated); forewing length, about 8.3 mm. Relative head measurements: width, 8.0; length, 6.5; clypeal length, 2.3; clypeo-antennal distance, 0.5; lower interocular distance, 5.0; upper interocular distance, 4.3. Agrees with male except as follows: inner orbits subparallel except for upper fourths which converge distinctly above; facial fovea much broader than an ocellus, nearly three times as long as broad; first flagellar segment distinctly longer than broad, second broader than long, third as broad as long, remainder longer than broad; outer hind tibial spur nearly as long as inner. Clypeus and lower part of supraclypeal area irregularly very coarsely punctate, ridges between punctures shining, small shining area on middle of supraclypeal area; rest of head (except impunctate but minutely roughened fovea) more finely and rather closely punctate, punctures of frons and genal and hypostomal areas as close as possible and arranged in more or less distinct rows; scutum and scutellum much more coarsely punctate than vertex, especially on discs, center of scutum with shiny area in which punctures are widely separated; depressed margins of metasomal terga strongly punctured, punctures somewhat finer than but as dense as those of rest of terga, except for narrow impunctate edges; second to fourth metasomal sterna (and perhaps more apical ones which are missing in the specimen) very finely and closely punctured. Light brown apices of femora and bases and apices of tibiae inconspicuous on middle and hind legs. Pubescence light ochraceous, darker on vertex and dorsum of thorax, that of face of the usual sort, not obscuring surface, that of scutum and scutellum broadly plumose, black hairs intermixed on scutum, scutellum, and just below forewing base; outer sides of tibiae with hairs largely fuscous, light fuscous on front tibia.

TYPE MATERIAL: Holotype male, Tooradin, Victoria, January 11, 1946 (Owen Dawson), in the collection of the Commonwealth Scientific and Industrial Research Organization; this is Rayment's allotype of "*Paracolletes subdolosus* Cockerell" (Rayment, 1949e). Allotype female, same data but February 5, 1946, in the collection of the Common-

wealth Scientific and Industrial Research Organization; this is the type of Rayment's manuscript name, *Paracolletes dolosus*. Five male paratypes, same locality and collector, January 11 and 15, 1946, February 5, 1946, and February 19, 1942. (The paratype dated February 5, 1946, is labeled as allotype of Rayment's manuscript name, *Paracolletes dolosus*.) One male paratype, Black Rock, Sandringham, Victoria, January 26, 1950 (T. Rayment). One male paratype same locality, February 2, 1950 (Les Rush). One male paratype, Highett, Victoria, February 15, 1946. One male paratype, Watsonia, Victoria, February 10, 1941. The paratypes are in the collection of the Commonwealth Scientific and Industrial Research Organization and the University of Kansas.

As indicated above, the specific name of this species was provided by Rayment in manuscript.

***Leioproctus (Baeocolletes) calcaratus*,
new species**

Plate 3, figure 4; text figures 46, 57

This species, like *L. mas*, has a very flat, smooth clypeus. It differs from *mas* in the nearly smooth rather than coarsely punctate tegulae and in the more shining and less closely punctate integument of the whole body. There is little chance that the two names represent sexes of one species.

FEMALE: Length, 6.5 mm.; wing length, about 4.3 mm. Relative head measurements: width, 12.6; length, 10.0; clypeal length, 2.9; clypeo-antennal distance, 0.7; lower interocular distance, 7.7; upper interocular distance 8.5. Inner orbits converging below except for upper parts which converge slightly above; clypeus flat, smooth and polished except for scattered large punctures mostly anterolaterally, apex broadly truncate, with distinct angle at end of truncation; supraclypeal area with large, triangular, flat, polished, impunctate area; facial fovea dull, impressed, little more than twice as long as broad, upper end reaching level of anterior margin of posterior ocellus; interocellar distance slightly greater than ocellocular distance, much greater than ocelloccipital distance; punctures of head of moderate size, separated by less, usually much less, than a puncture width, those of lower parts of face coarser than elsewhere,

ground between punctures shining; first flagellar segment about as broad as long, second and third about twice as broad as long, others except the last all broader than long; scutum and scutellum with punctures about as large as those of vertex, separated by more than a puncture width of smooth, shining ground; mesepisternum with punctures slightly coarser, also widely separated, ground shining but minutely roughened; propodeal triangle finely granular, with vague indications of a few longitudinal striae on subhorizontal part; metepisternum and sides of propodeum minutely roughened, dull, the former with subhorizontal striae; metasomal terga minutely roughened with small, well-separated punctures; sterna more shining with coarser punctures. Head and thorax black, mandibles reddish apically; flagellum dark brown above, pale brown beneath; tegula translucent testaceous; legs dark brown, small segments of tarsi, bases and apices of tibiae, and apices of femora yellowish brown; wings slightly brownish, veins and stigma dark brown; metasoma red above, red brown beneath, lateral area on each tergum infuscated, that of first tergum extending onto dorsum and occupying lateral fourth of tergum, that of second tergum extending a shorter distance onto dorsum. Pubescence white, rather short on dorsum, not forming metasomal bands, brownish around basitibial plate and brown around pygidial plate and in apical part of prepygidial fimbria.

TYPE MATERIAL: Holotype female, Belele, Western Australia, 52-3071, in the Western Australian Museum. Mr. A. Douglas informs me that this is Belele Station, near Cue, northwestern Australia, and that the collector was A. Snell.

The specific name refers to the thick, curved, hind tibial spurs.

***Leioproctus (Baeocolletes) mas*, new species**

Plate 3, figure 3

This species is obviously related to *Leioproctus calcaratus* as shown by the flat, shining clypeus and supraclypeal area and other characters. It could be the male of *calcaratus* but differs by several characters such as the punctate tegulae which probably are specific rather than sexual.

MALE: Length, nearly 7 mm.; forewing length, nearly 4.5 mm. Relative head measurements: width, 11.3; length, 8.5; clypeal length, 2.6; clypeo-antennal distance, 0.9; lower interocular distance, 5.6; upper interocular distance, 7.4. Agrees with description of *calcaratus* (female) except as follows: upper parts of inner orbits subparallel; large punctures rather numerous on lateral parts of clypeus (absent medially); facial fovea absent; punctures around and lateral to ocelli coarser and much more widely separated than those of frons, those of lower parts of paracocular areas not coarser than those of frons; scutum and scutellum with punctures as large as those of midposterior part of vertex, separated by less than a puncture width; tegula with punctures nearly as large as those of scutum, close; mesepisternum with coarser punctures, as large as those of clypeus, separated by less than a puncture width; propodeal triangle without striae; metasomal terga 1 to 4 with punctures dense, finer than those of scutum, posterior margins broadly impunctate, depressed, translucent; remaining terga with punctures coarser, more widely separated, ground finely roughened and dull, margins as in preceding terga; sterna minutely roughened and dull, with well-separated punctures. Tibiae and tarsi especially of front legs largely yellowish brown; metasoma red-brown middorsally on first three terga, grading into dark brown laterally and on more posterior terga; tergal margins translucent yellowish. Pubescence all whitish, longer, especially on face, than in *calcarata*.

TYPE MATERIAL: Holotype male, 5 miles north of Nocatunga, southwestern Queensland, November 13, 1949 (E. F. Riek), in the collection of the Commonwealth Scientific and Industrial Research Organization.

The specific name is given in allusion to the fact that the type of this species is the only male of its subgenus so far collected.

***Leioproctus (Baeocolletes) minimus*, new species**

Plate 3, figure 5

This species differs from *L. mas* in its smaller size, punctate and less flattened clypeus, yellowish labrum and mandibles, shorter antennae, and other characters.

MALE: Length, 4.5 mm.; forewing length, 3 mm. Relative head measurements: width, 7.5; length, 6.9; clypeal length, 1.8; clypeo-antennal distance, 0.9; lower interocular distance, 4.2; upper interocular distance, 5.0. Inner orbits converging below except for upper two-fifths which are subparallel; clypeus slightly convex, slightly protuberant, apex broadly truncate, with distinct angle at end of truncation; supraclypeal area with large, slightly convex, shining, impunctate area; rest of head strongly and in most areas rather closely punctate; facial fovea absent; interocellar distance greater than ocellocular distance, much greater than ocelloccipital distance; flagellum short and thick, first segment broader than long, second and third more than twice as broad as long, fourth about twice as broad as long, fifth to tenth much broader than long, eleventh longer than broad; punctation of thorax similar to that of head but punctures mostly more widely separated by shining ground, those of scutum and scutellum slightly finer; metepisternum strongly transversely striate; propodeum dull and granular; metasomal terga with punctures separated by about a puncture width of dull, minutely roughened ground, posterior margins broadly depressed, translucent, impunctate and shining; sterna minutely roughened, rather shining, punctures sparse and weak. Head and thorax black, mandible yellow, red apically; labrum yellow; antenna brown, under side of flagellum pale; tegula translucent yellow testaceous; legs dark brown basally but tarsi, tibiae, and apices of femora yellow-brown; wings slightly brownish, veins and stigma brown; metasoma dark brown beneath, black above, with posterior margins of terga broadly translucent yellow-brown, posterior margins of punctured, elevated parts of terga 1 to 3 reddish brown. Pubescence whitish, rather dense on lower part of face but not wholly obscuring surface, longest on face, sides and venter of head and thorax, fifth and following terga, and apical fringe of fifth sternum, not forming metasomal bands or sternal fringes except the fifth.

TYPE MATERIAL: Holotype male, Meekatharra, Western Australia, September 25, 1931 (Harvard Expedition, Darlington), in the Museum of Comparative Zoölogy.

The specific name refers to the small size of this bee.

Leioproctus (Andrenopsis) douglasiellus,
new species

Plate 3, figure 6; text figure 47

This species differs from *Leioproctus flavorufus* in its much smaller size. In theory this might be the female of *nigrifrons* or *wilsoni*, being about the same size and of the opposite sex, but it comes from the opposite side of Australia and has strikingly different punctation. In *douglasiellus* the mesepisterna are shining and much more coarsely punctate than the scutum, while in *nigrifrons* the mesepisterna are dull and granular. This character is unlikely to be sexual. The almost wholly black metasoma distinguishes this species from others in the subgenus.

FEMALE: Length, 8 mm.; wing length, almost 5 mm. Relative head measurements: width, 15.8; length, 13.6; clypeal length, 4.6; clypeo-antennal distance, 1.8; lower interocular distance, 9.5; upper interocular distance, 9.0. Inner orbits approximately parallel except for upper parts which converge slightly above; facial foveae about three times as long as broad, lower ends bluntly pointed, upper ends subtruncate, apex of clypeus broadly truncate; interocellar distance slightly less than ocellocular distance, about twice ocelloccipital distance; first flagellar segment about 1.5 times as long as broad, others, except last, all broader than long. Punctures of lower part of face of moderate size, separated by less than half of a puncture width of ground; punctures gradually finer on upper part of face and vertex, those of genal areas still finer; punctures of dorsum of thorax finer than those of vertex, quite close together; mesepisternum with punctures nearly as large as those of clypeus, separated by more than a puncture width of minutely roughened but shining ground; propodeal triangle dull and granular, more coarsely rugose basally; metasomal terga rather dull because of minute close punctures, sterna similar laterally but medially shining with rather coarse, sparse punctures. Color black, mandible reddish yellow except for dark apex; flagellum brown, paler beneath; tegula translucent yellow testaceous; legs dark brown basally, but apices of femora,

tibiae (entirely except basitibial plate), and tarsi reddish yellow; wings grayish, a little darker apically, veins and stigma dark brown; posterior sixth of first metasomal tergum reddish brown; second to fourth terga with apical margins translucent yellowish brown; venter of metasoma largely reddish brown. Pubescence whitish, that of dorsum of head and thorax with yellow or ochraceous tint, that of venter and sides of body moderately long, that of dorsum exceedingly short, marginal areas of scutum with short and broadly plumose hairs; outer surface of hind tibia around basitibial plate with fuscous hairs; apical part of prepygidial fringe and hairs of sixth tergum brown.

TYPE MATERIAL: Holotype female, Pearce, Western Australia, 54-128 (A. Douglas), in the Western Australian Museum. Two female paratypes, same locality, 54-132 and 54-124. Mr. Douglas tells me that all the specimens were taken on January 1, 1954.

This species is named for Mr. Athol Douglas who has done much collecting to make known the bees of Western Australia.

Leioproctus (Andrenopsis) nigrifrons,
new species

Plate 3, figure 7; text figures 154-156

This species differs from all others in the subgenus that are known in the male sex by the lack of yellow face marks. The inner hind tibial spur is longer than the outer but not swollen and curved as in *flavorufus*. The punctuation and other characters, as well as known distribution, are very different from those of *douglasiellus*, which is known only from the female.

MALE: Length, about 7 mm.; forewing length, nearly 5 mm. Relative head measurements: width, 15.4; length, 12.1; clypeal length, 3.5; clypeo-antennal distance, 1.3; lower interocular distance, 8.0; upper interocular distance, 9.0. Inner orbits converging below except for upper parts which converge slightly above; facial fovea absent (vaguely indicated as somewhat smooth area in paratype); apex of clypeus broadly truncate, apical third of clypeus strongly convex seen in profile; interocular distance less than ocellocular distance, greater than ocellocapital distance; first flagellar segment distinctly

longer than broad, second broader than long, third as long as broad, fourth to eleventh slightly longer than broad, last much longer than broad. Convex lower part of clypeus with scattered coarse punctures on smooth, shining ground; rest of lower part of face with somewhat finer punctures separated by less than a puncture width of mostly dull ground; frons with finer, close punctures; vertex with punctures somewhat coarser than those of frons and separated by minutely roughened ground; dorsum of thorax with punctures about size of those of frons, separated by a puncture width or less of dull ground; mesepisternum dull and granular, with scattered punctures as large as those of supraclypeal area, separated by about two puncture widths; propodeal triangle coarsely rugose basally, otherwise dull and granular; metasomal terga rather dull because of small, close punctures; sterna shiny with few punctures. Color black, mandible reddish yellow except for dark red apex; scape reddish yellow; flagellum dark brown, paler beneath; tegula translucent reddish yellow; coxae, trochanters, and upper sides of bases of femora dark brown; legs otherwise reddish yellow; wing coloration as in *douglasiellus*; apical parts of metasomal terga reddish brown, about one-fifth of first tergum and progressively narrower bands on following terga of the same color; venter of metasoma largely reddish brown. Pubescence whitish, slightly yellowish dorsally, nearly absent from apical convex part of clypeus, long, dense and covering surface on rest of clypeus and lower part of paraocular area, rather long on sides and venter, forming long preapical fringes on metasomal sterna 2 to 4 and especially long on sternum 5; pubescence of dorsum of thorax rather short, that of metasomal terga exceedingly short.

TYPE MATERIAL: Holotype male, Sunnybank, southern Queensland, December 9, 1936 (Chippendale), in the Queensland Museum. One male paratype without data, but, since the pin is somewhat unusual and like that of the holotype, it was probably taken with the holotype; it is in the Snow Entomological Museum of the University of Kansas. Both specimens were originally in the collection of the University of Queensland.

The specific name refers to the lack of yellow on the face; males of other species of the subgenus have such yellow.

Leioproctus (Chrysocolletes) crenulatus,
new species

Plate 3, figure 10; text figures 161-163

This species exhibits some of the distinctive features of the subgenus *Chrysocolletes* and is best compared with *moretonianus*. For example, the robust body, the forward position of the ocelli, the small, almost parallel-sided stigma, the crenulate antennae of the male, and the steeply sloping and rather short basal zone of the propodeum and the carina on the outer surface of the middle tibia are suggestive of *moretonianus*. However, *crenulatus* differs from that form in the fact that the flagellum is most strongly crenulate medially rather than apically, in the less completely vertical propodeal profile, in the much longer pubescence of the metasoma, and especially in the hidden sterna and genitalia which are more or less as in typical *Leioproctus* rather than very peculiar as in *moretonianus*. Discovery of the female or of other similar species may show that *crenulatus* should be subgenerically distinct. At present it seems that the relation to *Chrysocolletes* is obvious on the basis of external characters, but the genitalia and sterna show so many similarities to *Leioproctus*, *sensu stricto*, that *crenulatus* seems to occupy a position midway between the two groups.

MALE: Length, 11 mm.; forewing length, 7 mm. Relative head measurements: width, 8.0; length, 6.2; clypeal length, 2.3; clypeo-antennal distance, 0.5; lower interocular distance, 4.8; upper interocular distance, 5.0. Inner orbits weakly converging below except that lower parts diverge slightly (both interocular measurements therefore subjective); clypeal margin broadly truncate, angle at end of truncation rounded; surface of clypeus weakly concave in profile, not protuberant; antennal bases near middle of face, upper margin of socket slightly below middle of eye; interocular distance subequal to ocellocular distance, less than ocelloccipital, median ocellus midway between antennal bases and posterior edge of vertex, seen in profile; scape reaching median ocellus, flagellum rather

short but slender, first and third segments about 1.5 times as long as broad, second longer than broad, fourth and following segments progressively longer, sixth about twice as long as broad and more distal ones even longer; third and following flagellar segments crenulate beneath, most strongly so in middle of flagellum; outer side of middle tibia with small apical spine and carina extending from spine upward almost to middle of tibia; posterior coxa with small ventral apical tooth; metanotum simple; propodeum with steeply sloping basal zone shorter than metanotum, rounding onto vertical surface of propodeum; wing venation as illustrated for *moretonianus* (stigma being slightly less than half as long as costal margin of marginal cell) except that stigma is slightly broader and not quite parallel sided and base of vein r is near middle of stigma; pygidial plate represented by undefined bare ridge. Punctuation of face and genal areas close, moderately coarse below, especially on lower part of clypeus, progressively finer above so that upper parts of frons (to level of ocelli) and genal areas are quite finely punctate; vertex with punctures as coarse as those of middle of clypeus and separated by irregular shiny ground, small impunctate area posterolateral to lateral ocellus; scutum and scutellum with punctuation similar to that of vertex but on most of scutum except marginal areas and on anterocentral part of scutellum punctures widely separated, about two puncture widths of shiny and nearly smooth ground between them; mesepisterna more coarsely punctured; metepisterna shiny, with scattered small punctures, not striate; propodeum punctate except for triangle which is shining and very weakly, minutely roughened; metasomal terga dull, with small punctures separated by about a puncture width; apices of terga rather narrowly impunctate but minutely roughened; apical parts not depressed except weakly on fourth and fifth terga; sterna more shiny and more coarsely punctured; large, basal, sparsely punctured areas on first four sterna. Color black, mandible red except for black tip; tegula dark brown; tarsi (except distitarsi), bases and apices of tibiae, anterior surfaces of tibiae (especially front tibia), and apices of femora reddish brown; apical mar-

gins of metasomal terga brownish; wings grayish, veins and stigma dark brown. Pubescence rather long, whitish, ochraceous on vertex and dorsum of thorax, erect and not forming bands on metasoma, long yellowish fringe on fifth sternum; sixth sternum without median tuft, only sparsely hairy.

TYPE MATERIAL: Holotype male, Wallangarra, southern Queensland, November 7, 1958, on flowers of *Pultenaea* (C. D. Michener), in the collection of the Commonwealth Scientific and Industrial Research Organization.

The specific name refers to the crenulate flagellum.

Neopasiphae simplicior, new species

Plate 4, figure 1; text figures 169, 170

This species differs from the other known species, *mirabilis* and *insignis*, which are probably the sexes of a single species, by its smaller size and less-modified antennae and legs. In the following description contrasting statements to indicate the characters of *mirabilis* are given in parentheses.

MALE: Length, 7 mm.; wing length, 5 mm. Black, the clypeus, labrum, mandible except apex, transverse supraclypeal mark, and antennal scape yellow. Following parts creamy yellow: under sides of front and middle femora, apices of all femora; anterior surfaces of tibiae and bases and apices of tibiae; front tarsus, middle and hind basitarsi; transverse subapical bands on terga 1 to 6, each band emarginate on anterior edge sublaterally, emarginations farthest apart on second tergum and progressively closer posteriorly; comparable bands on sterna 2 to 5 but with emarginations so enlarged that bands consist of three creamy spots connected by very narrow arcuate lines. Posterior margins of terga and sterna behind creamy bands translucent brownish. Small segments of middle and posterior tarsi brown, tibial spurs translucent testaceous. Antennal pedicel and first two flagellar segments black (yellow beneath in *mirabilis*), the first brownish basally; rest of flagellum dark brown above, yellowish brown, darkened apically, beneath. Pubescence whitish, yellow on face, dense, short yellowish hairs among longer ones on dorsum of thorax. Wings slightly dusky apically, veins and stigma dark brown.

Inner margins of eyes converging below, clypeus uniformly convex and most protuberant medially (upper part most protuberant in *mirabilis*); antennal scape smooth and shining beneath (slightly dull in *mirabilis*), broadly flattened, more than twice as long as broad (less than twice in *mirabilis*); first flagellar segment narrow basally, 1.5 times as long as broad, second much broader than long, middle flagellar segments slightly broader than long (1.5 times as long as broad in *mirabilis*), propodeal triangle wholly declivous in profile (upper part sloping in *mirabilis*); femora not incrassate as in *mirabilis*, posterior coxa and trochanter unmodified (enlarged, with tooth on trochanter, in *mirabilis*); fore femora concave beneath, with ventral basal area of dense white pubescence (absent from *mirabilis*); fore basitarsus longer than rest of tarsus, expanded about as in *mirabilis*; middle tibial spine large (not the long horn of *mirabilis*); hind tibia of ordinary form, about four times as long as broad; hind basitarsus broad, flattened, two and a half times as long as broad, about as wide as tibia (about 1.5 times as long as broad and broader than tibia in *mirabilis*.) Punctuation coarser than in *mirabilis*.

TYPE MATERIAL: Holotype male, Camington, Western Australia, October 16, 1954 (R.P. McMillan), in the Western Australian Museum. Dr. G. F. Mees suggests that the locality is really Cannington, a suburb of Perth.

The specific name refers to the fact that the antennal and leg structure is more simple, less elaborate, than that of the only relative of this species, *Neopasiphae mirabilis*.

Hesperocolletes douglasi, new species

Plate 4, figure 2; text figures 176-181

MALE: Length, 12 mm.; forewing length, probably nearly 8 mm. (wing margins entirely worn off so that length cannot be accurately determined). Relative head measurements: width, 8.3; length, 6.5; clypeal length, 2.3; clypeo-antennal distance, 1.3; antennocellar distance, 1.2; interocellar distance, 1.2; ocellular distance, 1.6; ocellocipital distance, 0.9; lower interorbital distance, 4.5; upper interorbital distance, 5.3. Inner margins of eyes converging below throughout their lengths; median ocellus surrounded by distinct grooves

which unite anteriorly to form short, deep, median, longitudinal furrow extending down on frons; frontal carina extending beyond furrow to end as distinct tubercle below level of antennal bases; subantennal sutures slightly converging above, twice as long as diameter of antennal socket; summit of clypeus slightly convex; apex of clypeus subtruncate, extending well below lower ends of eyes; *surface of clypeus scarcely convex in profile but protuberant*, midapical part as far in front of lower anterior orbits as width of eye seen from side; labrum uniformly convex, less than three times as broad as long; mandible parallel sided except for basal expanded part; apex bidentate because of subapical inner tooth; mouthparts of the usual style for *Leioproctus*, mentum fairly well sclerotized and parallel sided, submentum V-shaped; *maxillary palpus not reaching apex of galea*, first segment longest, third shortest, others subequal; labial palpus longer than maxillary, fourth segment longest, first next, and second and third subequal and shorter; genal area widest above, not so wide as eye seen from side; scape reaching middle of anterior ocellus, shorter than first two flagellar segments together; flagellum long, reaching metanotum, last four segments tapering slightly so that last segment is only half or two-thirds as thick as middle segments; first segment about 1.5 times as long as wide, other segments about twice as long as wide. Middle and especially hind femora and tibiae somewhat thickened, hind femora about twice as long as broad, lower margin with rounded, shining, longitudinal ridge; hind tibia slightly curved, *without basitibial plate*, hind tibial spurs nearly straight, finely ciliate, inner longer than outer and not so long as tibial diameter; hind basitarsus nearly five times as long as wide, subparallel sided, slightly arcuate; distitarsi slightly swollen, thicker than mediotarsal segments. Body shining, smooth between punctures, with moderate-sized punctures which are close together on lower paraocular areas, supraclypeal area, and central part of vertex, but are separated by about a puncture width on scutum: clypeus with longitudinal median impunctate band, broadest above; supraclypeal area with longitudinal median impunctate line; metepisternum, propodeal triangle, and lower lateral

parts of propodeum smooth and impunctate; triangular pygidial area ill defined, impunctate, and with coarse, irregular, transverse wrinkles. Color black, labrum, mandibles (except for dark bases and apices), and clypeus reddish yellow; under side of flagellum testaceous; tegula, posterior lobe of pronotum, tarsi, and posterior margins of metasomal sterna brown; posterior margins of metasomal terga smooth, translucent testaceous; wings brownish, veins and stigma brownish black. Pubescence rather long and white on head, sides and venter of thorax, and under sides of femora and tibiae, that of clypeus shorter and sparser than rest of face; short fuscous hairs intermixed near ocelli; dorsum of thorax with hairs rather short and sparse, mostly fuscous; outer surfaces of tibiae and tarsi with fuscous or yellowish fuscous hairs; first metasomal tergum and sterna (except sixth) with rather long white hair, that of sterna sparse; second tergum with shorter white hair; remaining terga with short fuscous hairs except for longer whitish subapical ones which are too sparse to give the impression of fasciae; seventh tergum with pubescence entirely short and nearly black; sixth sternum with pubescence short and fuscous.

TYPE MATERIAL: Holotype male, Rottnest Island, near Perth, Western Australia, 38-2607, in the Western Australian Museum.

This species is named for Mr. Athol Douglas of the Western Australian Museum, who collected the specimen on February 9, 1938. It is badly worn; hence further search for the species should be made somewhat earlier in the season.

***Trichocolletes (Trichocolletes) burnsi*,
new species**

Plate 4, figure 7

This species is described here as an illustration of a wholly black species of group *b* of the genus, with no metasomal bands. *Trichocolletes latifrons* is superficially similar but has weak apical bands of white hair on the terga, especially laterally and posteriorly. The claws of the female are untoothed, in contrast to *latifrons* which has a strong basal tooth on each claw.

FEMALE: Length, 13 mm.; wing length, 9.5 mm. Black, anterior margin of clypeus, labrum, and mandibles except apices yellowish

brown; flagellum dark brown beneath; tegula dark brownish medially; metasoma with a feeble iridescence, as in other black species of the genus. Pubescence grayish white, long and fuscous on vertex, very short and fuscous on dorsum of thorax, fuscous beneath wing bases, largely blackish on outer surfaces of tibiae, fuscous on metasomal sterna except for apical lateral white patches on first four sterna, black on fifth and sixth terga and sterna. Wings slightly brownish, veins and stigma dark brown. Inner margins of eyes strongly diverging below; clypeus strongly protuberant; supraclypeal area convex, with small tubercle just above level of lower margins of antennal sockets; vertex seen from front not convex. Scape slender, first flagellar segment less than twice as long as broad, middle flagellar segments about 1.5 times as long as broad. Clypeus with scattered, large, ill-defined punctures, sparse anteriorly; rest of lower part of face with fine punctures on dull ground; rest of head dull but impunctate. Thorax with fine punctures on a dull ground, triangular area of propodeum dull but not punctate. First four terga with very scattered punctures on sericeous background, punctures denser laterally; remaining terga rather densely punctured; pygidial plate with longitudinal median convexity. Claws simple.

TYPE MATERIAL: Holotype female, Wentworth Falls, New South Wales, October 7, 1930 (A. N. Burns), in the A. N. Burns collection to be deposited in the National Museum of Victoria.

I am indebted to Mr. Burns, for whom this species is named, for the opportunity to study this species.

Trichocolletes (Trichocolletes) marginatulus,
new species

Plate 4, figures 9, 10; text figures 201-203

To judge by specimens in various Australian museums, this species has often been identified as *Paracolletes marginatus*. The new species is, however, much smaller than that species and even slightly smaller than *Trichocolletes venustus* which it closely resembles in appearance. It differs from *venustus* in the hairless eyes, slightly swollen antennal scape of the male, and other characters. From *marginatus* it differs by the short flagel-

lum of the male, the lack of a protuberant carina along the middle of the upper margin of the mandible of the male, the dark rather than ferruginous tibiae and tarsi of the male, the toothed claws of the female, and other characters. The hair on the flagellum of the male is suggestive of that of *T. chrysostomus* but is shorter and the flagellum is not expanded basally as in that species.

MALE: Length, 11 mm. (varying to 10.5); wing length, 6.5 mm. Black, anterior margin of clypeus brownish; labrum and mandibles (except for dark apices) yellowish brown; scape ferruginous; under side of rest of antenna dark brown; paler on second, third, and eighth to tenth flagellar segments; tegula fuscous, brown centrally; apices of femora, bases and apices of tibiae, anterior side of fore tibia, and all tarsi reddish brown; posterior marginal bands on metasomal terga 1 to 5 straw colored, about as wide as flagellum. Pubescence of head and thorax fulvous, brightest on face; pubescence of legs pale fulvous, some fuscous hairs on outer side of hind tibia. Pubescence of first two terga and of sterna yellowish, rather long and suberect, that of terga 3 to 7 depressed and largely fuscous, pale at margins of terga. Wings pale grayish, veins and stigma blackish. Inner margins of eyes parallel; clypeus only moderately protuberant; supraclypeal area with large, triangular, elevated area, pointed above, sloping down to level of clypeus anteriorly, nearly bare in contrast to rest of face; vertex seen from front slightly convex. Scape slightly swollen, less than four times as long as broad, middle flagellar segments less than 1.5 times as long as broad, under surfaces of flagellar segments 1 to 6 or 7 with erect hairs about one-third as long as flagellar diameter; first flagellar segment slightly longer than second. Clypeus, supraclypeal area, and lower paraclypeal areas punctate, with shining ground between punctures; upper lateral concavities of face shining; head and thorax otherwise dull and impunctate; metasoma finely and closely punctate, slightly shining, more sparsely punctate and shining ventrally.

FEMALE: Agrees with description of male but antenna black, scape slender, first flagellar segment less than twice as long as second, middle flagellar segments slightly longer than broad; metasomal bands on terga 1 to 4 only.

Pubescence, especially of head, paler, that of lower part of face and of genal areas white, clypeus only sparsely pubescent instead of completely covered; apices of hairs on dorsum of head and thorax black; hairs of basitibial plate and adjacent parts of tibia dusky. Triangular area above clypeus evident but less prominent than in male. Clypeus more coarsely punctate than in male, punctures irregular, poorly defined, separated by less than their diameters; supraclypeal area partly impunctate below. Claws each with large, broad, basal tooth.

TYPE MATERIAL: Holotype male, allotype female, and a paratype of each sex, Dunwich, Stradbroke Island, southern Queensland, on flowers of *Dillwynia peduncularis*, August 21, 1958 (C. D. Michener). The holotype and the allotype are in the collection of the Commonwealth Scientific and Industrial Research Organization; the paratypes, in the Snow Entomological Museum of the University of Kansas.

The specific name alludes to the similarity to *Trichocolletes marginatus* and to the somewhat smaller size of the new species.

***Trichocolletes (Callocolletes) pulcherrimus*,
new species**

Plate 4, figures 11, 12; text figures 207–209

This is the largest and reddest species of the genus. The male differs from that of other species of the genus in the incrassate legs, the enormous tooth on the anterior trochanter, and the absence of hind tibial spurs. *Trichocolletes rufibasis* seems to be slightly modified in the same direction but retains hind tibial spurs. Both sexes differ from others of the genus by the unusually long stigma and its merging into the thickened base of vein r.

MALE: Length, 17 mm. (varying to 16 mm.); wing length, 10 mm. Head and thorax black; clypeus, labrum, and mandibles except apices yellow. Antenna yellow, scape ferruginous dorsally, upper sides of flagellar segments 1 to 5 narrowly infuscated, flagellar segments 4 to 11 each with basal black spot on under side. Tegula ferruginous. Legs ferruginous except for black coxae and yellowish tarsi. Metasoma red, apical margins of terga broadly golden, bases of terga 4 to 6 with large black areas, base of third tergum with

small middorsal black area (absent from paratype). Pubescence bright fulvous, appressed and yellow at sides of face, forming long apical fringes on sterna. Wings brownish hyaline, veins and stigma brown. Inner margins of eyes distinctly diverging below; clypeus strongly protuberant; lower margin of mandible broadly expanded to blunt tooth slightly before middle; vertex seen from front hardly convex. Scape not thickened, more than four times as long as broad; first flagellar segment longer than any of the others, more than twice as long as broad, middle flagellar segments about 1.5 times as long as broad, last flagellar segment very short, broader than long, slightly produced to one side. Legs incrassate, distitarsi and claws notably large, femora roughly twice as long as broad, anterior trochanter produced ventrally to an enormous median spine; middle tibial spur half as long as basitarsus; hind tibia without spurs, expanded apically and subapically, ventral apex produced distally as broad lamella; hind basitarsus broad, arcuate, with longitudinal ventral carina ending in apical protuberance. Head finely punctate, surface between punctures minutely roughened; thorax impunctate, dull; metasoma impunctate and dull basally, finely punctate apically.

FEMALE: Agrees with description of male (varying to 18 mm. in length) but only lower half of clypeus yellow; antenna blackish above (rufescent apically), ferruginous beneath, with bases of flagellar segments 3 to 10 black; legs wholly red, coxae infuscated, anterior coxa black; metasoma entirely red except for infuscated pygidial plate. Dorsal thoracic vestiture short and dense. Lower margin of mandible not expanded. Scape slender; first flagellar segment rather slender, about twice as long as wide, middle flagellar segments slightly longer than broad. Legs normal. Clypeus with coarse, ill-defined punctures. Claws cleft.

TYPE MATERIAL: Holotype male and a female paratype, Narrogin, Western Australia, November 1, 1935, in the Western Australian Museum. Allotype female, 10 miles south of Perenjori, Western Australia, November 1, 1958 (E. F. Riek), in the collection of the Commonwealth Scientific and Industrial Research Organization. One male paratype, Beverley, Western Australia, in the Snow

Entomological Museum of the University of Kansas.

The specific name has been given because this is one of the prettiest as well as one of the largest and most conspicuous species of its genus.

***Ctenocolletes albomarginatus*, new species**

Plate 5, figures 1, 2

This species is a close relative of *Ctenocolletes nicholsoni*. Aside from the measurements given below, this species is described only in terms of differences from *nicholsoni*.

FEMALE: Length, 18 mm.; forewing length, 13 mm. Relative head measurements: width, 11.5; length, 9.2; clypeal length, 3.6; clypeo-antennal distance, 1.0; lower interocular distance, 7.5 (orbits curved so that proper measurement is not obvious); upper interocular distance, 6.4. Differs from *nicholsoni* in its somewhat smaller size, on the average more numerous teeth on the tibial spurs (front, 7-9, in *nicholsoni* 4-6; middle 13-19, in *nicholsoni* 10-16; hind 7-9, in *nicholsoni* 6-7); first to fourth metasomal terga with narrow apical bands of white hair, contrasting sharply with broad fulvous band of fifth tergum and fulvous hair of sixth (in some paratypes white band of fourth tergum nearly absent) (in *nicholsoni* bands, especially on third and fourth terga, are light fulvous and broad, occupying two-fifths of exposed parts of terga).

TYPE MATERIAL: Holotype female, 6 miles north of Watheroo, Western Australia, September 11, 1952 (McIntosh and Calaby), in the collection of the Commonwealth Scientific and Industrial Research Organization. One female paratype, Moorine Rock, Western Australia, September, 1952 (D. L. McIntosh), in the Western Australian Museum. One female paratype, Mullewa, Western Australia, September (L. J. Newman), in the Snow Entomological Museum of the University of Kansas. Specimens of *nicholsoni* were collected at the same place and month. One female paratype labeled Merredin, Western Australia, 48-216 (A. Douglas), is in the Western Australian Museum, but according to Mr. Douglas this specimen was actually from Dedari, taken on flowers of mallee *Eucalyptus*.

Specimens of this species in the Western

Australian Museum are labeled by Rayment as a species of *Anthoglossa*, with an unpublished specific name referring to the golden apex of the metasoma. The type specimen of that "*Anthoglossa*," however, is a probably undescribed species of *Stenotritus*.

The specific name is given in allusion to the apical bands of white hair on the metasomal terga.

***Ctenocolletes notabilis*, new species**

Plate 5, figure 3; text figures 220-222

This species, known from only one poorly preserved individual (lacks antennae beyond fifth segment, lacks one front leg and last two tarsal segments of the other), is so distinctive as to merit description. In the relatively small claws and arolii and large propodeal triangle (continued as a broad band into propodeal pit) it resembles the genus *Stenotritus*, although its other generic features are like those of *Ctenocolletes*. Striking features unique to the species include the very short antennal scape, less than one-third as long as the first flagellar segment, the long and slender basitarsi, those of the middle leg as long as the tibia, and the position of the first recurrent vein almost at the base of the second submarginal cell.

MALE: Length, 18 mm.; length of forewing, 13 mm. Relative head measurements: width, 10.4; length, 8.4; clypeal length, 2.6; clypeo-antennal distance, 0.8; lower interocular distance, 5.6; upper interocular distance, 2.5. Inner orbits strongly converging above; clypeal margin broadly truncate; ocelli more than twice as far from posterior edge of vertex as from antennal bases; scape about 1.5 times as long as broad, less than one-third as long as first flagellar segment; genal area little more than half as wide as eye medially, where broadest, tapering to almost nothing at upper extremity of eye; middle and hind tibial spurs small, straight, delicate, ciliate; front basitarsus shorter than tibia, slender, gently arcuate; front trochanter with flat, blunt, ventral projection; middle basitarsus about as long as tibia, scarcely arcuate; hind basitarsus shorter than tibia, slightly arcuate; propodeal triangle longer than scutellum, margins where they enter propodeal pit separated by about width of third flagellar segment; second submarginal cell receiving first

recurrent vein near base; first to sixth metasomal sterna broadly exposed, posterior margins broadly translucent, the translucent parts broader medially on posterior sterna so that thicker parts of sterna are broadly emarginate; seventh sternum a transverse band; eighth a broad plate with small apical truncate emargination. Punctuation of face fine and close except on clypeus where punctures are more widely separated; genal area and thorax somewhat more coarsely punctate, ground between punctures minutely roughened; metasoma with punctation similar to that of thorax, sterna and more apical terga with punctures more widely separated than on basal terga. Color black; mandible reddish medially; first flagellar segment brown; legs brown, darker basally, paler apically, front tarsi yellowish brown; wings slightly brownish, veins and stigma dark brown; pygidial plate red. Pubescence extraordinarily long and much of it dense, that of legs out to basitarsi as long as that of body but relatively sparse (pubescence of type matted so that details of pattern may not be apparent); hairs especially dense on supraclypeal area; hairs grayish white with weak fulvous tint (lacking beneath) except for black hairs occupying outer posterior quarter of tegula, a black band across middle of scutellum extending laterally onto axillae, black hairs intermixed with pale ones under and behind hind wing base and a few beneath front wing, black hairs on outer sides of middle and posterior tibiae, black hairs intermixed with pale across middle of second metasomal tergum, and replacing pale hairs (except for pale apical fasciae) on terga 3 to 5, a few dark hairs intermixed on tergum 6.

TYPE MATERIAL: Holotype male, Geraldton, Western Australia, 1917 (W. W. Froggatt), in the collection of the Commonwealth Scientific and Industrial Research Organization.

In various morphological features this species is one of the most notable of the genus; hence the specific name.

Ctenocolletes ordensis, new species

Plate 5, figure 4; text figures 217-219

This species differs from others in the genus by the red legs, the black, unbanded metasoma, the long fulvous hair of the head and

thorax, the parallel inner orbits (a character shared with the brilliant green *smaragdinus*), the arcuate hind tibiae, and other features.

MALE: Length, 16 mm.; length of forewing, 11.5 mm. Relative head measurements: width, 9.7; length, 7.9; clypeal length, 3.0; clypeo-antennal distance, 0.7; lower interorbital distance, 5.3 (orbits so curved as to make this measurement of doubtful value); upper interorbital distance, 5.0. Inner orbits approximately parallel; clypeal margin broadly truncate; posterior ocelli slightly closer to antennal bases than to posterior margin of vertex; scape slightly less than half as long as first antennal segment and as long as middle flagellar segments; genal area slightly narrower than eye seen from side; middle and hind tibial spurs ciliate, middle and inner hind spurs gently curved, outer hind spur quite strongly curved at its middle; hind tibia distinctly arcuate (bowed outward medially); propodeal triangle about as long as metanotum; first to sixth metasomal sterna broadly exposed, posterior margins of more apical ones slightly and irregularly emarginate, fifth usually with distinct small median emargination; seventh produced posteriorly at each side so that apex has broad, deep emargination; eighth a broad plate, with small, submembranous, produced apical projection the tip of which is dorsally reflexed. Clypeus, lower parts of paraocular areas, and vertex rather strongly punctured, punctures mostly separated by less than a puncture width, longitudinal impunctate zone on clypeus; rest of head mostly more finely and sparsely punctate; impunctate area lateral to ocelli; supraclypeal area very finely and closely punctate; surface between punctures minutely roughened but shiny, dullish on genal areas; dorsum of thorax with sculpturing similar to that of vertex except for small discal area on scutum which is more sparsely punctured; sides and venter of thorax dull and scarcely punctate; metasoma with well-separated piliferous punctures, coarser on apical terga. Black; mandible red medially, yellowish apically; antenna with under side brown, third and following flagellar segments paler, last segment brown above as well; legs red except for coxae and bases of trochanters; tegula, axillary sclerites, and bases of wing veins red; wings slightly brownish, stigma

and veins except basally dark brown; pygidial plate red. Hair of head and thorax long, dense, fulvous; legs with shorter fulvous hair; first two metasomal terga and first four sterna with long dull whitish or pale fulvous hair, not obscuring black surface beneath; rest of metasoma with black hair which is short on dorsal parts of third to fifth terga; on sterna and extreme sides of terga there is gradation from pale hairs of basal segments to black hairs of apical segments, but on dorsum the color change is abrupt.

TYPE MATERIAL: Holotype male and two male paratypes, Wotjulum, northern Western Australia, October 3, 1955 (A. Douglas), in the Western Australian Museum. Wotjulum is near Yampi, west of Derby. Two additional male paratypes without data.

The latter specimens are in the collection of the Western Australian Museum and were studied by Rayment. Undoubtedly they once had data labels, but Rayment was in the habit of removing such labels, which sometimes he later put back on the wrong specimens. In this case no such labels were returned to the specimens, but they were marked by Rayment as type and paratype of *ordensis*, which he placed in *Gastropsis*. The specific name that he used suggests that these specimens came from somewhere in the Ord River area of northern Western Australia. I have retained his specific name, since specimens so labeled may have been distributed to other collections.

***Euryglossa (Euhesma) australis*, new species**

Plate 5, figure 10; text figures 235, 236

This small yellow and metallic green species has the superficial appearance of a *Nomioides* (Halictidae). As shown by the short, broad, front basitarsi of the female, the short scape in the male, the lack of facial foveae, and the simple claws, the species is related to *Euryglossa altitudinis* and *ridens*, from which it differs by the strongly green color of the dark areas, the extensive yellow areas, and the presence of hairs on the membrane of the basal third of the forewing (as well as on the rest). There are numerous other distinctive features, one of the most unusual of which is the very short scape of the male, less than twice as long as broad.

FEMALE: Length, 5 mm.; wing length, 3.5 mm. Relative head measurements: width, 7.1; length, 5.6; clypeal length, 1.6; clypeo-antennal distance, 0.3; lower interocular distance, 4.3; upper interocular distance, 4.3. Clypeus distinctly convex seen in profile; clypeal truncation more than twice as wide as interantennal distance, margin lateral to truncation convex; upper margin of clypeus straight, distinct; subantennal suture about half as long as diameter of antennal socket; interantennal distance slightly less than antennoocular distance; antennal bases below middle of face and at lower third of eye length; inner orbits with lower two-thirds weakly converging below, upper third converging above; facial fovea absent; interocellar distance greater than ocellocular distance, much greater than ocelloccipital distance; genal area about half as wide as eye seen from side; pedicel large, longer than first flagellar segment; first flagellar segment as long as broad, remaining segments except last broader than long, middle and preapical segments much so; claws simple; basitibial area demarked posteriorly by strong carina but otherwise scarcely defined, length over one-fifth of tibial length; inner hind tibial spur coarsely serrate; outer surface of hind tibia with sparse curved bristles, with plumose hairs laterally; legs long and slender, front tibia widest medially, narrowed toward base and apex; front tarsus shorter than tibia, basitarsus little more than twice as long as wide; hind basitarsus about three-fourths as long as tibia; horizontal basal area of propodeum about as long as scutellum; costal margin of marginal cell about 1.15 times as long as stigma; second submarginal cell about as long as broad, half as long as first; fovea of second tergum not or scarcely impressed, about three times as long as broad. Body minutely roughened, head and thorax duller and more coarsely roughened than metasoma; punctures not distinct. Head and thorax metallic brassy green, the following parts yellow; mandible except reddish apex, labrum, scape, pedicel, pronotum except lower lateral part, lateral margins of scutum, axilla except fossa, scutellum, metanotum except laterally, tegula except transparent lateral and posterior parts, axillary sclerites, metepisternum, and sides of propodeum; legs yellow, with black basal

areas on coxae, femora except apices black, posterior sides of front and mid tibiae and whole hind tibia except ends dark brown; middle and hind tarsi and last four segments of front tarsus blackish; metasoma yellowish white, with large sublateral and anteromedian blotches on first tergum dark brown and with broad dark brown apical bands on terga 2 to 4 and apical sublateral spot on tergum 5; fovea of second tergum black; wings clear, veins of costal margin yellow basally, stigma light brown, other veins testaceous; under side of flagellum light testaceous. Pubescence whitish, very short and sparse dorsally.

MALE: Length (estimated), 3.5 mm.; wings, nearly 3 mm. Head collapsed so that relative measurements of allotype not meaningful but proportions about as in female. Agrees with description of female except as follows: interantennal distance more than antennocular distance; width of genal area and convergence of eyes not determinable; scape less than twice as long as broad, shorter than last flagellar segment; first flagellar segment distinctly broader than long, second to tenth slightly broader than long (sixth and following collapsed so that shape is an estimate only); claws bifid, inner prong short, front tarsus longer than tibia, basitarsus more elongate than in female; fovea of second tergum twice as long as broad. Yellow of pronotum limited to posterior lobe; mesepisternum and sides of propodeum greenish black; yellow apical areas of femora more extensive; tibiae and tarsi yellow; metasoma yellow, with dark areas similar to those of female but less extensive.

TYPE MATERIAL: Holotype female, allotype male, and six female paratypes, Ooldea, South Australia (A. M. Lea), in the collection of the Commonwealth Scientific and Industrial Research Organization. Two female paratypes, Karoonda to Peebinga, South Australia, in the collection of the Commonwealth Scientific and Industrial Research Organization and the University of Kansas. One female paratype, Little Desert, Victoria (1-9-10-49, E.M.), in the National Museum of Victoria; the number of the last specimen probably means January 9-10, 1949.

The specific name refers to the localities from which this species is known, in the southern part of the continent.

Euryglossa (Euhesma) hyphesmoides,
new species

Plate 5, figure 9

This rather small black species without yellow markings superficially resembles such species as *nigritula*, *wahlenbergiae*, and *perkinsi*. However, the eyes of the female which converge rather strongly below and are produced mesad above the bases of the mandibles and the deep linear facial foveae indicate a relationship with the genus *Hyphesma*. It seems probable that *Hyphesma* arose from such species as *Euryglossa hyphesmoides*, and on the basis of its morphology *hyphesmoides* might equally logically be placed in either genus. Perhaps the discovery of males of *hyphesmoides* will suggest its proper position more clearly. The large second submarginal cell which receives the first recurrent vein is the most noteworthy feature that excludes *hyphesmoides* from *Hyphesma*.

FEMALE: Length, 6 mm.; forewing length, about 4.3 mm. Relative head measurements: width, 9.2; length, 7.6; clypeal length, 2.5; clypeo-antennal distance, 0.5; lower interocular distance, 4.8; upper interocular distance, 5.9. Clypeus convex seen in profile, truncation much broader than interantennal distance and slightly concave; upper margin concave, distinct; subantennal suture about half as long as diameter of antennal socket; interantennal distance slightly longer than antennocular distance; antennae slightly below middle of face and below middle of eye; inner orbits distinctly converging below (although not so strongly as in *Hyphesma barbata*, *nitidiceps*, and others), only upper portions slightly converging above; facial fovea strongly impressed, linear, slightly more than half as long as eye, upper extremity slightly bent toward ocelli, lower extremity not curved mesad toward antenna, as in *Hyphesma barbata* and others; interocular distance greater than ocellocular distance and more than twice ocelloccipital distance; genal area nearly as wide as eye seen from side; pedicel as long as first two flagellar segments together; first two flagellar segments equal in length, each more than twice as wide as long; middle flagellar segments about twice as wide as long; claws with small inner tooth; basitibial area slightly less than half as long as tibia, defined largely by tubercles

(distal tubercles much reduced, possibly broken off, on the one tibia of the paratype that is visible): outer surface of hind tibia with simple hairs except near lateral margins where there are some plumose ones; inner hind tibial spur briefly pectinate, with about three teeth; subhorizontal area of propodeum much longer than metanotum; costal part of marginal cell about 1.3 times as long as stigma; second submarginal cell slightly longer than broad, more than half as long as first; fovea of second tergum rather vague, more than three times as long as broad. Body surface minutely roughened but shining, roughening almost absent and surface therefore strongly shining on face below antennae, posterior two-thirds of scutum, and disc of scutellum; clypeus coarsely punctate near anterior margin but disc with small punctures separated by several puncture widths and disc of supraclypeal area almost impunctate; rest of head with small punctures, mostly separated by several puncture widths, but closer just behind antenna; scutum with anterior third punctate, with punctures about the size of those of frons, separated by about a puncture width; rest of scutum with punctures progressively sparser, posterior median part impunctate; scutellum with punctures closer; rest of thorax with punctures much finer and sparse, propodeum virtually impunctate as is metanotum; metasoma with inconspicuous punctures ventrally, laterally, and posteriorly. Color black, mandible reddish subapically, flagellum brown beneath, extreme bases and apices of tibiae, anterior side of front tibia, most of front tarsus, and apices of middle and hind tarsal segments brown; tegula translucent brown; wings slightly brownish, veins and stigma dark brown. Pubescence whitish, brown around pygidial plate, very short on and nearly absent from posterior two-thirds of scutum, on scutellum, and on dorsum of first four terga.

TYPE MATERIAL: Holotype female and one female paratype, Mutdapilly, southern Queensland, October 3, 1958 (C. D. Michener), on flowers of *Eucalyptus tereticornis*. The holotype is in the Queensland Museum; the paratype, in the Snow Entomological Museum of the University of Kansas.

The specific name refers to the similarity

in the eyes and the facial foveae to those of species of the allied genus *Hyphesma*.

Euryglossa (Euhesma) malaris, new species

Text figures 239, 240

In its long labial palpi this species resembles *E. palpalis*, *platyrhina*, and *goodeniae*, but the palpi are even larger than in those species. Moreover, the clypeus, although flat in profile, is strongly convex and protuberant, as is the frons to a lesser extent. Most remarkable of all, this species has a long malar area and simple claws, the former unique in the genus, the latter known in this subgenus only in the wholly different *australis* and its allies.

FEMALE: Length, nearly 5 mm. (estimated from curled type specimen); forewing length, more than 3.5 mm. Relative head measurements: width, 9.0; length, 7.9; clypeal length, 2.4; clypeo-antennal distance, 0.1; lower interocular distance, 5.5; upper interocular distance, about 5.9. Face nearly flat seen in profile but strongly protuberant so that anterior-most part of clypeus (along longitudinal midline) is in front of anterior margin of eye by almost eye width; malar area about as long as basal width of mandible; apex of clypeus rather broadly truncate; upper margin of clypeus distinct, straight, almost as high as lower margin of antennal socket; inter-antennal distance greater than antennocular distance; antennal bases well below middle of face and at level of lower fourth of eyes; inner orbits slightly converging below in lower three-fifths, converging above in about upper two-fifths; facial fovea more than half as long as eye, distinctly impressed, linear, lower part somewhat broadened; interocellar distance probably slightly more than ocellocular distance and much more than ocelloccipital distance; genal area distinctly widest above, about half as wide as width of eye seen from side, very narrow below; labial palpus longer than maxillary palpus, segments in increasing length in the order 2, 1, 4, 3; antennal pedicel longer than first two flagellar segments taken together; first three flagellar segments each about twice as broad as long, remaining segments except last distinctly broader than long; claws simple; basitibial plate indicated by tubercles; outer surface of hind tibia with simple hairs except marginally where they

are plumose; inner hind tibial spur pectinate (outer margin of outer spur also briefly pectinate); subhorizontal area of propodeum slightly longer than metanotum; costal margin of marginal cell about 1.4 times as long as stigma; second submarginal cell about as long as broad, narrowed toward costa, much less than half as long as first; fovea of second tergum a barely recognizable dark area. Head shining, ground between punctures not or scarcely roughened; clypeus and supraclypeal area with coarse, irregular punctures, almost absent from center of supraclypeal area which is therefore impunctate; frons with rather coarse punctures, separated by a puncture width or less medially but by several puncture widths laterally near facial fovea; rest of head more finely punctate; dorsum of thorax with surface minutely roughened, somewhat dull, with fine punctures separated in most areas by several puncture widths; mesepisterna shiny, with small, widely separated punctures; propodeum minutely roughened, weakly punctured, triangle impunctate; metasoma shining, minutely roughened, not punctate. Head and thorax black; mandible reddish, yellowish subapically; antenna dark brown, flagellum lighter beneath; tegula translucent testaceous, brown mesially; legs brown, bases of front and middle tibiae yellowish; metasoma brownish yellow, with broad, diffuse, ill-defined brown bands across first four terga, leaving bases (hardly so for first) and apices brownish yellow; wings slightly brownish, veins and stigma brown. Pubescence whitish, short on dorsum of thorax and first four metasomal terga.

TYPE MATERIAL: Holotype female, Mount Lofty Range, South Australia (N. B. Tindale), in the collection of the Commonwealth Scientific and Industrial Research Organization.

The specific name alludes to the large malar areas, which are unique in the genus.

Euryglossa (*Euhesma*) *palpalis*, new species

Plate 5, figures 7, 8; text figures 237, 238

The flat clypeus and large labial palpi of this species suggest *E. platyrhina*, but *palpalis* differs from that species by having coarse punctation on the lower part of the clypeus, almost no sign of the separation of the clypeus

from the frons, and in other characters. In *palpalis*, also, the clypeus is not so flat as in *platyrhina* but is slightly elevated laterally and excavated medially. *Euryglossa goodeniae* belongs to the same group but is more like *Euhesma* in general, having, for example, a clearly delimited and less flat clypeus.

FEMALE: Length, 5 mm.; forewing length, about 3.75 mm. Relative head measurements: width, 8.8; length 8.3; clypeal length, 3.3; clypeo-antennal distance, 0.2; lower interocular distance, 5.4; upper interocular distance, 5.4. Face nearly flat seen in profile; clypeus together with supraclypeal area, which are almost indistinguishably fused, broadly and shallowly concave medially, slightly raised laterally; apex of clypeus broadly truncate; upper margin of clypeus probably weakly concave; subantennal suture probably much shorter than diameter of antennal socket; interantennal distance nearly twice antennoocular distance; antennal bases below middle of eyes; inner orbits subparallel, lower parts weakly converging below, upper parts converging above; facial fovea less than half as long as eye, depressed, lower part weakly defined, lower part broadest, about as wide as scape, median part narrowed, upper part slightly broadened; interocellar distance subequal to ocellocular distance, much greater than ocelloccipital distance; genal area widest above, more than half as wide as eye seen from side, very narrow below; labial palpus as long as maxillary palpus, second segment shortest, first next, and third and fourth equal, each almost as long as first and second together; pedicel slightly shorter than first two flagellar segments taken together; second flagellar segment shortest, nearly twice as wide as long, all flagellar segments except last distinctly broader than long; claws each with large inner tooth (style of *Euryglossa*, *sensu stricto*); basitibial area delimited by tubercles; outer surface of hind tibia with simple hairs except marginally where there are plumose ones; inner hind tibial spur briefly pectinate; subhorizontal area of propodeum longer than metanotum; costal margin of marginal cell about 1.7 times as long as stigma; second submarginal cell about as long as broad, somewhat narrowed toward costa, less than half as

long as first; fovea of second tergum not impressed, a broad blackish area less than twice as long as wide. Body minutely roughened throughout, dorsum of head (including face above antennae) and of thorax dull; clypeus, especially lower part, with large scattered punctures; rest of head and thorax with much smaller punctures, those of sides coarser than those of dorsum, the latter separated by several puncture widths; propodeum weakly punctured, triangle not punctured; metasoma without punctures dorsally on first four terga, otherwise with weak punctures. Head and thorax black, mandible dark reddish apically; under side of flagellum dark brown; tegula dark brown; legs dark brown, tarsi lighter, base of middle tibia and basal half of anterior surface of front tibia yellowish testaceous; metasoma dark brown, margins of segments broadly lighter translucent brown, first four terga each with diffuse, preapical, transverse, dull yellowish streak laterally; wings slightly brownish, veins and stigma brown. Pubescence whitish, rather abundant for the group, shorter on dorsum of thorax and first four metasomal terga than elsewhere.

MALE: Length, 5 mm.; wing length, 3.5 mm. Relative head measurements: width, 7.6; length, 7.2; clypeal length, 2.3; clypeo-antennal distance, 0.5; lower interocular distance, 4.4; upper interocular distance, 4.8. Agrees with description of female except as follows: interantennal distance greater than antennoocular distance; inner orbits slightly more converging below; facial fovea weakly defined, lower part broad as in female but upper part probably tapering to slender point; pedicel shorter than in female, first flagellar segment shorter than others; claws apically cleft, as usual in males; inner hind tibial spur ciliate; anterior and outer surfaces of front tibia largely yellowish testaceous; metasoma with first two and seventh segments redder than others, lateral yellowish streaks on terga absent.

TYPE MATERIAL: Holotype female, Hotham Heights, Victoria, altitude 5900 feet, February 1, 1957, on snow, in the collection of the Commonwealth Scientific and Industrial Research Organization. Allotype male, Mount Buffalo, Victoria, 4000 feet in altitude, December 30, 1930 (L. F. and P. Anam), in the collection of the Commonwealth Scientific

and Industrial Research Organization. One female paratype without hind legs, same data as allotype, in the Snow Entomological Museum of the University of Kansas.

The specific name refers to the unusually long labial palpi.

Euryglossa (Euhesma) perkinsi, new species

Plate 5, figure 5; text figure 247

This species is similar to *neglectula* and *wahlenbergiae*. It is unknown in the male, but in the female it differs from *neglectula* by the same characters that differentiate *wahlenbergiae* from *neglectula*. It differs from *wahlenbergiae* by the flat clypeus, coarser punctuation, and the virtually indistinguishably fused clypeus and supraclypeal area.

FEMALE: Length, more than 6 mm.; forewing length, about 4.3 mm. Relative head measurements: width, 10.1; length, 8.4; clypeal length (estimated in view of fusion of clypeus and supraclypeal area), 2.4; clypeo-antennal distance (estimated), 0.3; lower interocular distance, 6.0; upper interocular distance, 6.5. Clypeus flat in profile, truncation much broader than interantennal distance, gently concave; upper margin of clypeus not (or scarcely) evident; antennal positions as described for *wahlenbergiae* except a little above lower thirds of eyes; eyes and facial fovea as described for *wahlenbergiae*; interocular distance greater than ocellocular distance and at least three times ocelloccipital distance; genal area and antenna as in *wahlenbergiae*; claws with prongs more widely separated than in that species and less parallel; tibia with tubercle which probably marks apex of basitibial plate near middle of tibia; outer surface of hind tibia with simple hairs except basally and at sides; hind tibial spur and propodeum as described for *wahlenbergiae*; costal margin of marginal cell about 1.5 times as long as stigma; second submarginal cell about as long as broad, less than half as long as first; pygidial plate as in *wahlenbergiae*. Body minutely roughened but dorsum of thorax less dull than in *wahlenbergiae*, clypeus and supraclypeal area almost without roughening and brilliantly shining; punctuation about as in *wahlenbergiae* but that of thorax coarser so that punctures of scutum and of frons are of same size. Color and pubescence as described for *wahlenbergiae* but tarsi and

anterior side of front tibia brown, margins of metasomal segments paler.

TYPE MATERIAL: Holotype female, 17 miles south of Dalby, southern Queensland, October 20, 1958, on flowers of *Wahlenbergia* (C. D. Michener), Queensland Museum. Three female paratypes, same data, in the Snow Entomological Museum of the University of Kansas.

This species is named for Mr. F. A. Perkins, Reader in Entomology of the University of Queensland, who greatly facilitated my studies of bees in Queensland.

Euryglossa (Euhesma) rufiventris, new species

Text figures 250, 251

Being black with a red metasoma, this species is superficially similar to *Euryglossa rainbowi*, from which it differs by the narrower facial foveae (those of *rainbowi* are especially broad below) and by the coarse punctures of the scutum. The latter character is a very unusual one in the subgenus, shared only by *crabronica*, a very different species with yellow metasomal bands. The new species also resembles *E. macula*, from which it differs not only by the coarse punctation with the ground between the punctures smooth but by the smaller stigma (less than two-thirds as long as the costal margin of the marginal cell) and by the position of the first recurrent vein beyond rather than basal to the first transverse cubital.

FEMALE: Length, nearly 8 mm.; forewing length, more than 4.5 mm. Relative head measurements: width, 11.3; length, 10.0 clypeal length, 4.3; clypeo-antennal distance, 1.2; lower interocular distance, 6.8; upper interocular distance 7.5. Face gently convex; clypeal truncation narrow, about equal to interantennal distance, margin lateral to truncation rounded; upper margin of clypeus nearly straight, weakly indicated; subantennal sutures slightly longer than diameter of antennal sockets, slightly diverging above; interantennal distance slightly less than antennocular distance; antennal bases slightly above middles of eyes; inner orbits slightly converging below except for upper parts which converge above; facial fovea strongly depressed, less than half as long as eye, broadly linear, broadest above, where it is nearly as wide as antennal scape; interocular

distance greater than ocellocular distance; genal area slightly narrower than eye seen from side; pedicel slightly longer than first flagellar segment which is about as long as broad; second flagellar segment shorter and third even shorter, nearly twice as broad as long; fourth and fifth flagellar segments about as broad as long and remaining segments longer than broad; claws each with small inner tooth as usual in the group; basitibial area delimited by a carina on posterior side, distal part of carina broken (except on one leg of paratype), anterior margin only delimited by short carina and apex or area not indicated except by apex of posterior carina; outer surface of hind tibia with coarse, simple bristles, without branched hairs; inner hind tibial spur coarsely serrate (or very briefly pectinate); subhorizontal basal area of propodeum about as long as metanotum and strongly sloping; costal margin of marginal cell about 1.6 times as long as stigma; second submarginal cell much longer than broad, slightly more than half as long as first, costal margin only about half as long as posterior margin; fovea of second tergum about three times as long as broad; pygidial plate strongly convex, not flat on surface, somewhat narrowed near base. Head and thorax with surface between punctures shining, not or scarcely roughened; lower half of face with punctures small and widely separated, especially disc of clypeus with punctures minute and separated by many puncture widths, subapical part of clypeus with a few irregular large punctures; propodeal triangle impunctate, rest of propodeum and metepisternum weakly punctate; rest of the head and thorax strongly punctate, most coarsely and least closely so on scutum and scutellum where punctures are mostly separated by more than a puncture width; metasoma dull with minute roughening, punctures small and widely scattered middorsally, more conspicuous and denser apically, laterally, and ventrally. Color of head, thorax, and legs black; mandible reddish apically; flagellum brown beneath; tegula dark brown; bases of fore and middle femora yellowish; metasoma red, fovea of second tergum and entire sixth tergum black or nearly so; wings slightly brownish, veins and stigma brown. Pubescence whitish, moderately abundant, about as long dorsally as

ventrally except on dorsal aspects of first three metasomal terga which have only short, sparse hair

TYPE MATERIAL: Holotype female, Trayning, Western Australia, October 31, 1958 (E. F. Riek), in the collection of the Commonwealth Scientific and Industrial Research Organization. One female paratype, same data, in the Snow Entomological Museum of the University of Kansas.

The specific name refers to the red metasoma, an unusual feature in the genus *Euryglossa*, subgenus *Euhesma*.

Euryglossa (Euhesma) wahlenbergiae,
new species

Plate 5, figures 11, 12; text figures 241-243,
248, 249

This small black species without pale markings is similar, at least superficially, to *neglectula* but differs by the broader head, the much shorter and more robust flagellum, with even the middle segments in the female almost twice as broad as long and in the male distinctly broader than long, in the continuation of the vertex in the male horizontally behind the posterior ocelli (it is declivous almost immediately behind them in *neglectula*), and in the briefly pectinate rather than coarsely ciliate inner hind tibial spur of the female.

FEMALE: Length, 5 mm.; forewing length, 3.5 mm. Relative head measurements: width, 9.0; length, 6.9; clypeal length, 2.1; clypeo-antennal distance, 0.1; lower interocular distance, 5.7; upper interocular distance, 6.2. Clypeus convex seen in profile, truncation broader than interantennal distance, margin lateral to truncation rounded; upper margin of clypeus nearly straight, distinct; subantennal sutures scarcely evident because clypeus closely approaches antennae; interantennal distance much more than antennocular distance; antennae below middle of face and at lower third of eyes; inner orbits, except above, where they are subparallel, slightly converging below; facial fovea inconspicuous, weakly depressed, inner margin poorly defined, length more than half of length of eye, width about that of scape; interocellar distance about equal to ocellocular distance and about twice ocellocipital distance; genal area nearly as broad as eye seen from side; pedicel

slightly longer than first two flagellar segments taken together, second and third flagellar segments shortest, each more than twice as broad as long, middle flagellar segments about twice as broad as long; claws cleft with subparallel prongs, inner one scarcely shorter than outer; basitibial area more than one-third as long as tibia, defined by carinae basally but at apex by a tubercle only; outer surface of hind tibia with plumose hairs, without simple hairs or bristles; inner hind tibial spur briefly pectinate; subhorizontal area of propodeum scarcely longer than metanotum; costal margin of marginal cell about 1.4 times as long as stigma; second submarginal cell about as long as broad and slightly more than half as long as first; fovea of second tergum vaguely defined, slightly depressed, about three times as long as broad; pygidial plate of the usual form for the genus but with apical half abruptly depressed (and separated by a sharp line) as compared to basal half. Body entirely minutely roughened, scutum, scutellum, and metanotum quite dull, other surfaces more shining, the metasoma and supraclypeal area being the most shiny; clypeus with rather coarse punctures, coarsest preapically, those of upper part of disc separated by more than a puncture width; rest of head and thorax with finer punctures, those of thorax finer than those of head; propodeal triangle impunctate; metasoma with minute piliferous punctures laterally, posteriorly, and ventrally. Color black, mandible reddish subapically; under side of flagellum brown; tegula translucent brown; extreme bases of tibiae, mediotarsi, and distitarsi brownish; pygidial plate dark brown; wings milky brownish, veins and stigma brown; margins of metasomal terga translucent but dark. Hairs whitish, rather abundant and long ventrally, laterally, and especially on last two metasomal segments, short on dorsum of thorax and first four metasomal terga.

MALE: Length, nearly 5 mm.; wing length, 3.5 mm. Relative head measurements: head width, 9.8; head length, 7.4; clypeal length, 2.0; clypeo-antennal distance, 0.3; lower interocular distance, 6.3; upper interocular distance, 6.5. Agrees with description of female except as follows: clypeus nearly flat in profile, anterior margin broadly rounded; in-

ner orbits more nearly parallel; interocellar distance greater than but not twice ocellocapital distance; pedicel not so long as first two flagellar segments together, none of the segments twice as broad as long but all except last broader than long; basitibial area nearly completely defined; inner hind tibial spur ciliate. Clypeal surface, except laterally, about as dull as scutum and distinctly duller than rest of face, punctures not so coarse as in female and not much coarser than those of frons. Mandible largely reddish; flagellum brown, lighter beneath than above; front tibia except posterior surface and all tarsi testaceous, basitarsi infuscated; posterior margins of metasomal terga and sterna translucent brownish.

TYPE MATERIAL: Holotype female and allotype male, Helidon, southern Queensland, October 20, 1958, on flowers of *Wahlenbergia* (Michener and Sekhon), in the Queensland Museum. Eleven female and six male paratypes, same data, in the Snow Entomological Museum of the University of Kansas. Six female and one male paratypes, Stanthorpe, southern Queensland, November 7, 1958, on *Wahlenbergia* (C. D. Michener), in the Snow Entomological Museum of the University of Kansas. One female, 13 miles north of Stanthorpe, southern Queensland, December 29, 1958, on *Wahlenbergia*, in the Snow Entomological Museum of the University of Kansas.

In addition, both sexes have been taken at Canberra, Australian Capital Territory, November 3, 1945, November 3 and 26, 1946 (E. F. Riek); the specimens are in the collection of the Commonwealth Scientific and Industrial Research Organization. Dr. Riek tells me that he collected on flowers of *Wahlenbergia* on these dates, and in all probability the specimens were taken on them.

The specific name refers to the presumably oligolectic relationship of this species to the Australian bluebells, *Wahlenbergia*.

***Euryglossa (Parahesma) tuberculipes*,
new species**

Plate 6, figure 1; text figure 260

This small species differs from its known relatives by the subgeneric characters listed

above. The red metasoma, long basitibial area (half as long as tibia) delimited by tubercles, and strongly pectinate hind tibial spurs easily separate *tuberculipes* from other species.

FEMALE: Length, 5 mm.; forewing length, nearly 4 mm. Relative head measurements: width, 8.1; length, 6.9; clypeal length, 2.2; clypeo-antennal distance, 0.5; lower interocular distance, 4.9; upper interocular distance, 4.9. Lower margin of clypeus broadly truncate, upper margin concave; lower two-thirds of inner orbits slightly converging below, upper thirds converging above; interocellar distance greater than ocellocular distance, about twice ocellocapital distance; pedicel about as long as first two flagellar segments which are about twice as broad as long, remaining segments progressively longer, all but the last broader than long; facial fovea distinctly impressed, less than half as long as eye, lower end about two-thirds as wide as an ocellus, well separated from eye, upper end narrow and approaching eye margin; genal area slightly more than half as broad as eye, widest near lower end of eye. Body strongly shining in spite of inconspicuous roughening of surface; clypeus with scattered, rather large punctures, lower half of frons roughened and with rather fine punctures separated by about a puncture width; anterior declivity of scutum, metepisternum, sides of propodeum, and metanotum with minute punctures; propodeal triangle impunctate; rest of head and thorax with rather large punctures (smaller than those of clypeus) separated by several puncture widths, those on disc of scutum so sparse that this area seems virtually impunctate. Head and thorax dark brown, mandible except for reddish apex and under side of flagellum testaceous; tegula translucent testaceous; legs brown, tarsi and anterior tibia testaceous; metasoma reddish brown, fovea of second tergum black; wings clear, scarcely brownish, veins and stigma brown. Pubescence white, sparse, especially short and sparse on dorsum of head and thorax.

TYPE MATERIAL: Holotype female, Victoria, 1912 (C. French), in the British Museum (Natural History).

The specific name refers to the coarse tubercles on the posterior tibiae.

Euryglossa (Callohesma) lacteipennis,
new species

Plate 6, figure 4

This species resembles *sulphurea* in its largely yellow color but differs in its larger size, more extensive black markings, whitish wings, longer facial foveae, and other characters.

FEMALE: Length, 7 mm.; forewing length, 4.5 mm. Relative head measurements: width, 10.0; length, 9.6; clypeal length, 3.0; clypeo-antennal distance, 0.7; lower interocular distance, 5.6; upper interocular distance, 5.6. Lower margin of clypeus weakly concave medially, upper margin scarcely concave; sub-antennal suture about as long as diameter of antennal socket; lower two-thirds of inner orbits slightly converging below, upper thirds converging above; interocellar distance about twice ocellular distance and also much greater than ocellocapital distance; pedicel nearly as long as first two flagellar segments which are nearly twice as broad as long, remaining segments progressively longer so that middle and preapical segments are only slightly broader than long; facial fovea linear, distinct, upper end curved toward ocelli, length more than half of length of eye; genal area about as wide as eye seen from side, strongly sloping mesad; horizontal zone of propodeum much longer than metanotum; wing characters as indicated in subgeneric description; fovea of second tergum less than three times as long as broad. Body with only very minute and widely scattered punctures; surface between punctures slightly shining, minutely roughened, except on lower part of face which is shining and scarcely roughened. Color yellow, grading to whitish on lower part of clypeus, base of mandible, lower genal area, pronotal lobe, metanotum, legs and metasoma, and to light brown on tibiae, tarsi, axillary sclerites, and antenna; tegula whitish and translucent pale brown; broad apical bands on metasomal terga dark brown, blackish basally; apices of mandibles red-brown; following areas black or dark: epistomal suture; subantennal suture and small area above and lateral to antennal sclerite; facial fovea; transverse bar behind posterior ocelli, extending through and enlarging in front of each ocellus, continued in front of anterior ocellus as line extending halfway

down middle of frons; dorsal thoracic sutures; broad line along pre-episternal groove; anterior end of propleuron; mark on pronotum before tubercle and on scutum above tubercle, latter mark continued as line along scutal margin above tegula; notalus, this line continued full length of scutum and joining strong bar across scutoscuteellar suture; lateral part of axilla; propodeal triangle and area on posterior face of propodeum; area beneath apex of each femur; longitudinal median line on anterior declivity of first metasomal tergum, and fovea of second tergum; wings whitish, veins and stigma testaceous. Hair whitish, rather abundant laterally, ventrally, on apex of metasoma, and on legs, sparse and short dorsally, that on outer sides of middle and posterior femora brownish.

TYPE MATERIAL: Holotype female, Yanchep, 32 miles north of Perth, Western Australia, December 20-31, 1935 (R. E. Turner), in the British Museum (Natural History).

The specific name refers to the milky or whitish wing membrane.

Euryglossa (Callohesma) sulphurea,
new species

Plate 6, figure 5

This species is rather small, differing in its wholly yellow coloration and small size from all previously described species of the subgenus. In these respects it resembles the even smaller, all or largely yellow forms in the genera *Brachyhesma* and *Xanthhesma* but differs from them in the pectinate hind tibial spur, the blunt marginal cell, the toothed claws, and other generic and subgeneric characters.

FEMALE: Length, 5.5 mm.; forewing length, nearly 4 mm. Relative head measurements: width, 7.7; length, 7.8; clypeal length, 2.2; clypeo-antennal distance, 2.8; lower interocular distance, 5.0; upper interocular distance, 4.8. Lower margin of clypeus broadly truncate; upper margin of clypeus concave; sub-antennal suture about as long as diameter of antennal socket; inner orbits with lower two-thirds slightly converging below, upper thirds converging above; interocellar distance slightly greater than ocellular distance and distinctly greater than ocellocapital distance; pedicel longer than first flagellar segment; flagellar segments except last all slightly broader than long; facial fovea distinct, linear,

broadened above where curved toward ocelli, much less than half as long as eye; genal area more than half as long as eye seen from side; horizontal zone of propodeum longer than metanotum; wing characters indicated in subgeneric description; fovea of second tergum about four times as long as broad. Body with only small and widely scattered punctures; surface between punctures brilliantly shining and only very inconspicuously roughened on head and thorax, except for sides of propodeum which are dull; metasoma more conspicuously roughened and less shining. Color entirely yellow except for red-brown apex of mandible, brown flagellum (paler beneath), light brown tarsi and outer surfaces of middle and posterior tibiae, black facial and second tergal foveae, narrow brown lines along dorsal thoracic sutures and along pre-episternal groove, and very fine black lines along notulus and median longitudinal groove of first tergum; tegula largely translucent, partly yellow; wings clear, veins and stigma testaceous. Pubescence whitish, very short and sparse dorsally, longer ventrally and on legs, that of outer surfaces of middle and posterior tibiae light brown.

TYPE MATERIAL: Holotype female, Gnowangerup, Western Australia, March 4, 1954 (A. Douglas), in the collection of the Commonwealth Scientific and Industrial Research Organization. Mr. Douglas writes that the specimen was taken on mallee *Eucalyptus*. Paratype female, same data, but labeled April 4, 1954, in the Western Australian Museum. The holotype is labeled as a paratype of *Euryglossa sulphurea* Rayment, a species that Rayment never described. I am pleased to accept his appropriate specific name, especially since there must be other specimens labeled by him in other collections.

Two female specimens from tea tree scrub, Hartley, South Australia, December 22, 1948, in the collection of the Waite Agricultural Institute, Adelaide, differ from the above description only in being slightly smaller, with the head less elongate (relative width, 8.0; length, 7.2). They probably represent a different species.

A male from Kukerin, Western Australia, in the Western Australian Museum, has a relatively broad head. It may be either *sulphurea* or a closely related species. In this

male the fovea of the second tergum is about five times as long as wide, not far from "linear."

As indicated above, the specific name was first given by Rayment. It refers to the almost wholly yellow body.

***Euryglossa (Xenohesma) evansi*, new species**

Plate 6, figure 11

This species differs from its relatives, *E. perpulchra* and *flavicauda*, by the almost wholly yellow thorax and by the flat, shining clypeus with punctures separated by more than a puncture width.

MALE: Length, nearly 6 mm.; forewing length, 4 mm. Relative head measurements: width, 8.7; length, 6.8; clypeal length, 2.1; clypeo-antennal distance, 0.3; lower interocular distance, 4.7; upper interocular distance, 3.5. Structure agrees with that as described for *flavicauda* except as follows: clypeus flatter; summit of eye separated from lateral ocellus by about two-thirds of diameter of ocellus. Punctuation as described for *flavicauda* except as follows: clypeus brilliantly shining although minutely roughened near upper and lateral margins, punctures mostly separated by more than a puncture width; supraclypeal area shining, finely roughened, the scattered small punctures distinct, scattered small punctures more distinct on frons also. Head black, the following parts yellow: Clypeus, labrum, mandible except red-brown tip, triangular supraclypeal area (black or largely so in some paratypes), lower extremities of paraocular areas, narrow line along inner orbit above level of antennae (absent from some), scape, pedicel, basal part of flagellum (especially beneath), line along summit of eye (absent from some), and line along posterior orbit extending up from patch behind base of mandible. Thorax yellow (reddish because of cyanide in specimens from the Australian Museum), sutures of dorsum and lower pre-episternal groove black, small posterior median scutal spot (absent from some), large U-shaped mark on scutum formed by bar along posterior margin and longitudinal bands extending forward from near axillae (in some cases this mark broken into three parts), and large area on mesosternum (absent from some) black; legs yellow, area on middle (and in some cases front) coxa black-

ish; metasoma yellow, fovea of second tergum black; flagellum brown above, testaceous beneath, except for basal yellow area; wings as in *flavicauda*. Pubescence as in *flavicauda*, but that of dorsum of head and thorax shorter than that of venter.

TYPE MATERIAL: Holotype male and two male paratypes, Cunnamulla, Queensland, October 15, 1940 (N. Geary), in the Australian National Museum. Fourteen male paratypes, same locality and collector, November, in the Museum of Comparative Zoölogy and the Snow Entomological Museum of the University of Kansas. The latter specimens are not reddened by cyanide, as are the former, but have the antennae mostly gone.

This species is named after Dr. John W. Evans, Director of the Australian National Museum in Sydney, through whose kindness part of the type series was available for my study.

***Euryglossa (Xenohesma) clypearis*, new species**

Plate 6, figure 12

This species is similar to *scutellaris* but smaller, with a largely yellow clypeus, and with certain other differences as listed below.

FEMALE: Length, 5 mm.; forewing length, 4 mm. Relative head measurements: width, 9.0; length, 7.8; clypeal length, 2.3; clypeo-antennal distance, 0.5; lower interocular distance, 5.5; upper interocular distance, 4.8. Agrees with description of *scutellaris* except as follows: interocellar distance slightly less than ocellocular distance and ocelloccipital distance; inner hind tibial spur with teeth more erect, so that it is briefly pectinate. Punctures of lower part of clypeus slightly larger than in *scutellaris*. Body dark brown or blackish, with clypeus (except lateral margins), two small dorsal pronotal spots (absent from some paratypes), pronotal tubercles, axillary sclerites, disc of scutellum, small spot on metanotum (absent from most paratypes), basolateral spot on second tergum and metasomal sterna yellow; legs brown with apices of fore and mid femora yellow; fore and mid tibiae yellow except for much of inner surfaces; flagellum dark brown above, lighter beneath; tegula translucent brown.

TYPE MATERIAL: Holotype female, Broomehill, Western Australia, 44-559, in the Western Australian Museum. Five female

paratypes, same data, 44-558, 44-560, 44-561, and 44-570/1, in the Western Australian Museum, and also in the Snow Entomological Museum of the University of Kansas. Mr. A. Douglas writes that the specimens were all taken by L. Glauert.

The specific name refers to the conspicuously yellow clypeus.

***Euryglossa (Xenohesma) federalis*, new species**

Plate 6, figure 10; text figure 272

This species resembles *ridens* and differs from the other species of the subgenus available in the female sex by the shining cuticle, relatively broad facial foveae, broadly truncate clypeus, nearly straight upper margin of the clypeus, and other characters. It differs from *ridens* by the shorter flagellum, with the middle flagellar segments much broader than long, by having the interantennal distance slightly greater than the antennocular distance, by the yellow supraclypeal area and scutellum, and by the yellowish brown metasoma.

FEMALE: Length, 5 mm.; forewing length, about 3.7 mm. Relative head measurements: width, 8.3; length, 6.5; clypeal length, 2.0; clypeo-antennal distance, 0.2; lower interocular distance, 5.8; upper interocular distance, 4.9. Lower margin of clypeus broadly truncate, oblique margin lateral to truncation nearly straight; upper margin scarcely concave; inner orbits very slightly converging below in lower two-thirds, distinctly converging above in upper thirds; interocellar distance distinctly greater than ocellocular distance and slightly greater than ocelloccipital distance; pedicel nearly as long as first two flagellar segments, all but last flagellar segment considerably broader than long; facial fovea distinct, dull and depressed on shining ground, broadly linear, about as wide as an ocellus, about half as long as eye, upper end bent toward ocelli; genal area nearly as wide as eye seen from side; inner hind tibial spur with short teeth so that it is briefly pectinate; fovea of second tergum a little more than twice as long as wide. Body shining, nearly smooth except for the slightly dull metepisternum, side of propodeum, and metasoma; lower half of face, scutum, scutellum, and metasomal sterna with some moderate-sized punctures, mostly separated much more than

a puncture width; fovea of second tergum dull in contrast to surrounding cuticle. Head and thorax dark brown, with following parts yellow: broad, semicircular clypeal area, filling upper part of clypeus but approaching lower margin of clypeus only medially, supraclypeal area, posterior dorsal band across pronotum, pronotal tubercle, axilla, scutellum, tegula (largely transparent), axillary sclerites, coxae (except large anterior brown area on anterior one), trochanters, femora (anterior one except base and apex mostly brown), anterior tibia except for light brown apex and line along posterior margin, and middle tibia except for brown outer surface; apex of mandible red-brown, base pale yellow; under side of flagellum testaceous; brown of fore and middle legs, especially fore tarsi, pale; metasoma light yellowish brown, a dark brown band just behind declivity of first tergum and dark brown areas, possibly resulting from discoloration, apically and midventrally; wings clear, veins and stigma light brown, stigma translucent except marginally; base of costal vein yellow. Pubescence sparse, whitish, very short on and almost absent from dorsum of metasoma.

TYPE MATERIAL: Holotype female, Cutter River, Australian Capital Territory, January 6, 1931 (A. L. Tonnoir), in the collection of the Commonwealth Scientific and Industrial Research Organization. One female paratype (darkened, probably by cyanide), same locality, February 6, 1947 (E. F. Riek), in the collection of the Commonwealth Scientific and Industrial Research Organization. One female paratype, Black Mount, Australian Capital Territory, January 8-9, 1931 (L. F. Graham), in the Snow Entomological Museum of the University of Kansas.

The specific name refers to the discovery of this species in the federal capital territory.

Euryglossa (*Xenohesma*) flavicauda, new species

Plate 6, figure 8; text figures 269-271

This species differs from its two relatives, *perpulchra* and *evansi*, by the less-extensive yellow areas, by having the interantennal distance less than the antennocular distance, and by the shining but strongly convex and strongly punctured clypeus.

MALE: Length, 6 mm.; wing length, about 4.3 mm. Relative head measurements: width,

10.0; length, 7.7; clypeal length, 2.3; clypeo-antennal distance, 0.5; lower interocular distance, 5.4; upper interocular distance, 3.0. Lower margin of clypeus broadly truncate, the margin lateral to truncation rounded; clypeus somewhat convex, upper margin concave; inner orbits arcuate, lower ends converging below, upper parts strongly converging above and almost meeting outer margins of lateral ocelli; interocellar distance less than ocelloccipital distance; antennal pedicel as long as first two flagellar segments; all flagellar segments except last broader than long, middle ones twice as broad as long; genal area less than half as wide as eye seen from side; stigma slightly shorter than costal margin of marginal cell; fovea of second tergum linear. Clypeus shining, rather coarsely punctured, punctures separated by about a puncture width, ground between punctures minutely roughened, especially near upper and lateral margins; lower extremities of paraocular areas shining and impunctate; supraclypeal area slightly shining, finely roughened, punctures few and inconspicuous; rest of head dull, finely roughened, without obvious punctures on frons or vertex; thorax shining but minutely roughened, metepisternum and sides of propodeum dull, small scattered punctures visible except on propodeum and metepisternum; metasoma minutely roughened, punctation inconspicuous or absent; dorsal surfaces of first four terga dull except for apical margins; rest of metasoma somewhat shining. Head and thorax black, with line along posterior side of scape and pedicel, labrum, dorsal part of pronotum, posterior lobe of pronotum, narrow lateral marginal line on scutum, tegula and sclerites of wing base yellow; legs yellow except coxae, large ventral area on each trochanter, posterior basal spot on mid femur, and basal half of posterior side of front femur, which are black; metasoma yellow except for black fovea of second tergum; mandible yellowish brown medially, red-brown apically; flagellum brown above, testaceous beneath; wings clear, veins and stigma testaceous. Pubescence whitish, rather abundant and about as long as width of femur except on dorsum of metasoma where it is almost absent.

TYPE MATERIAL: Holotype male and five male paratypes, "17 N" (17 miles north of?)

Broken Hill, New South Wales, November 19, 1949 (E. F. Riek), in the collection of the Commonwealth Scientific and Industrial Research Organization, and one paratype in the Snow Entomological Museum of the University of Kansas.

Among paratypes, some have more yellow markings than the type and thus approach *perpulchra*, which, however, has the clypeus shorter, more convex, dull, and much more closely punctate. Paratypes with the maximum amount of yellow have the following yellow areas in addition to those described above: basal parts of mandibles, anterior part of clypeus (yellow extending up into center of clypeus), scape, pedicel, under side of flagellum, large area between notali on scutum, extending back to emarginate posterior end in about middle of scutum, scutellum, axilla, metanotum, and small mesepisternal area behind pronotal tubercle. Such specimens also have the mid femur wholly yellow and front femur with only basal black spot on outer side.

The specific name refers to the wholly yellow metasoma of this beautiful species.

***Euryglossa (Xenohesma) primaria*, new species**

The name *primaria* was used by Rayment (in combination with a different generic name) for this species. Since he probably left labeled specimens elsewhere, I am using his unpublished specific name. This species resembles *villosula* in its long erect pubescence but differs in the largely yellow metasomal terga, and the largely black legs.

MALE: Length, 6 mm.; wing length, 4.5 mm. Relative head measurements: width, 10.6; length, 7.0; clypeal length, 2.0; clypeo-antennal distance, 0; lower interocular distance, 5.5; upper interocular distance, 3.9. Lower margin of clypeus broadly truncate, margin lateral to truncation rounded; clypeus slightly convex, upper margin straight so that there is no clypeo-antennal distance; inner orbit arcuate as in *flavicauda*, inner orbit separated from lateral ocellus by about two-thirds of ocellar diameter; pedicel little longer than first flagellar segment, middle flagellar segments twice as wide as long; genal area about half as wide as eye seen from side; stigma slightly shorter than costal margin of marginal cell; fovea of second tergum broad,

undefined, only vaguely recognizable, probably about three times as long as broad. Clypeus finely and closely punctate, rather dull; supraclypeal area and lower paraocular area similar, grading into dull, minutely roughened frons and vertex with scattered, ill-defined punctures; thorax and metasoma shining but finely roughened with scattered, small punctures, absent from propodeum. Head and thorax black, mandibles reddish subapically, under side of flagellum testaceous; tegula translucent black; legs black, with anterior tibia, tarsus, and apex of femur yellow, same parts of middle leg yellow but brownish area apically on tibia, and tarsus somewhat brownish, hind leg with apex of femur and last four tarsal segments yellow; metasomal sterna and last two terga dark brown; first tergum brownish black, with large subapical yellow spot; second to fifth terga yellow, with rather narrow brown apical margins; wings clear, basal part of costa yellow, stigma nearly clear, veins and margin of stigma brown. Pubescence short and whitish on dorsum of metasoma but elsewhere long (more than twice as long as femoral width) and dusky.

TYPE MATERIAL: Holotype male, "30 m." (Mr. E. F. Riek and Mr. A. Douglas interpret this as probably 30 miles north of) Bunbury, Western Australia, February 12, 1956, in the collection of the Commonwealth Scientific and Industrial Research Organization. Three male paratypes with the same data, in the collection of the Commonwealth Scientific and Industrial Research Organization and the Snow Entomological Museum of the University of Kansas. One male paratype without data, in the Western Australian Museum. Rayment is known to have removed locality labels from some of the material he studied from Western Australia. As the last paratype is mounted like the other specimens, it probably came from the same place. The holotype and paratypes were labeled as such with Rayment's manuscript name *primaria*.

***Euryglossa (Xenohesma) scutellaris*, new species**

Plate 6, figure 9; text figures 267, 268

This species resembles *E. maculata* in clypeal form, foveae, and other characters but differs in the black hind legs, the presence of yellow markings on the thorax, and the ab-

sence of large lateral yellow spots from the metasoma.

FEMALE: Length, 6.5 mm.; forewing, 4.5 mm. Relative head measurements: width, 10.3; length, 8.5; length of clypeus, 2.6; clypeo-antennal distance, 0.4; lower interocular distance, 5.9; upper interocular distance, 5.2. Lower margin of clypeus broadly rounded, with small, shining, more strongly convex median part below bases of longer hairs of clypeal margin; upper margin of clypeus concave; inner orbits concave, converging both above and below; interocular distance equal to ocellular distance, more than ocellocipital distance; pedicel longer than first flagellar segment which is about as long as broad, second to tenth flagellar segments broader than long; facial fovea broadly linear, narrower than an ocellus, more than half as long as eye, upper end curved mesially toward lateral ocellus; genal area more than half as wide as eye; inner hind tibial spur coarsely serrate; fovea of second tergum a little more than twice as long as wide. Body weakly shining, minutely roughened, with scattered small punctures except on propodeum and dorsum of first four metasomal terga; clypeal punctures slightly coarser than others. Body black, with dorsum of pronotum, pronotal tubercles, tegula (largely transparent), axillary sclerites, discs of scutellum and metanotum, venter of metasoma (discolored), and lateral margins of dorsum (first to fifth terga) yellow, yellow and black on metasoma meeting in irregular line and extending farthest onto dorsum on second tergum; fovea of second tergum black; fore and middle tibiae, all tarsi, and apices of femora yellow, posterior sides of tibiae brown apically; flagellum dark brown above, light brown beneath; mandibles red apically; wings clear, costa yellow basally, stigma translucent, veins (including margin of stigma) brown. Pubescence white; sparse and short, especially on dorsum.

TYPE MATERIAL: Holotype female, Seabrook, Western Australia, 31-1255, in the Western Australian Museum. Two female paratypes, same data, but with numbers 31-1238 and 31-1252, one of these in the Snow Entomological Museum of the University of Kansas. Mr. Athol Douglas writes that these specimens were taken by L.

Glauert on October 18, 1931, and that Seabrook is near Northam, 60 miles east of Perth.

The specific name refers to the conspicuously yellow disc of the scutellum.

***Xanthesma flava*, new species**

Plate 7, figure 1

This species is essentially completely yellow and thus differs from all others. It is probably closest to *X. brachycera* which, however, has dark bands on the metasoma and a black propodeal area. Like *X. brachycera*, it is larger and has shorter antennae than *X. furcifera*.

FEMALE: Length, 4.5 mm.; wing length, 3 mm. Relative head measurements: width, 6.7; length, 6.3; clypeal length, 1.8; clypeo-antennal distance, 0.4 (such a measurement is possible in spite of the contact of the antennal sclerite and the clypeus because of the concave upper margin of the clypeus; longitudinal measurement is made in the middle); lower interocular distance, 4.5; upper interocular distance, 3.9. Apex of clypeus broadly truncate, margins lateral to truncation rounded; inner orbits slightly converging below except for upper parts which are strongly converging above; first flagellar segment broader than long, longer than subsequent ones; second to seventh flagellar segments all about twice as broad as long; genal area more than half as wide as eye seen from side, lower end of genal area exceedingly narrow seen from side, less than half as wide as base of mandible. Body surface shining, lower half of face not roughened, but rest of body with inconspicuous fine roughening, coarsest on sides of propodeum; minute, widely separated punctures present except on propodeum and middorsal parts of first three metasomal terga. Color yellow throughout, apex of mandible, facial fovea, arolii, scutoscuteellar suture, and lateral fovea of second tergum black; antennal flagellum, middle of mandible, disc of scutum, and apical metasomal segments reddish yellow; middorsal part of metasoma dark, discolored from internal organs; metasomal sterna dark (discolored?). Wings, including stigma, hyaline; veins pale yellowish white. Hair sparse, white, that of dorsum short.

TYPE MATERIAL: Holotype female, Little Rocky Yard, Turn-off Lagoons, northern Queensland, September 20, 1930 (T. G. Campbell), in the collection of the Commonwealth Scientific and Industrial Research Organization. Paratype female, Ladysmith Yard, Turn-off Lagoons, northern Queensland, September 18, 1930 (T. G. Campbell), in the collection of the Commonwealth Scientific and Industrial Research Organization. Paratype female, on train window, Palcaldin, Queensland, October 2, 1931 (S. Flanders; received through P. H. Timberlake), in the Snow Entomological Museum of the University of Kansas.

The specific name refers to the almost wholly yellow body.

Xanthesma nigrior, new species

Plate 7, figure 2

This species is closest to *X. furcifera* but differs by the extensive black areas; in the male these include the dorsum of the head and much of the dorsum of the thorax. In the male of *nigrior* the lower interocular distance is less than the upper interocular distance; they are equal in the male of *furfifera*.

MALE: Length, nearly 3 mm.; wing length, more than 2 mm. Relative head measurements; width, 13.8; length, 10; clypeal length, 2.8; clypeo-antennal distance, 0.5; lower interocular distance, 8.4; upper interocular distance, 9.2. Apex of clypeus broadly truncate, margins lateral to truncation rounded; inner orbits slightly converging below except for upper thirds which converge slightly above; first flagellar segment the shortest, more than twice as broad as long, second about twice as broad as long; middle flagellar segments slightly broader than long; genal area narrower than eye seen from side, lower part near mandible more than half as broad as mandibular base. Body surface shining, minutely roughened, most coarsely so on sides of propodeum; with minute, widely separated punctures except on propodeum and middorsal parts of first three terga. Color yellow, top of head, down to irregular line two-fifths of distance from anterior ocellus to antennal base, dorsum of pronotum, scutum except for lateral margins and anterior lateral parts, propodeum except for anterior lateral por-

tions and fovea of second tergum, black; axillae, upper extremities of episterna, and metasomal terga (except seventh and basal band across second) dusky; metanotum and ill-defined lateral spots on scutellum dusky yellow (to dusky in paratype); apices of mandibles, flagellum (yellowish beneath), and distal tarsal segments reddish; wings clear, stigma yellowish transparent; veins and margin of stigma light brown. Pubescence sparse and white, short on dorsum.

FEMALE: Length, 3.5 mm.; wing length, about 2.75 mm. Relative head measurements: width, 17.3; length, 14.1; clypeal length, 4.1; clypeo-antennal distance, 0.5; lower interocular distance, 11.0; upper interocular distance, 10.8. Apex of clypeus broadly rounded; inner orbits converging below except for upper thirds which converge above; first three flagellar segments subequal, nearly twice as broad as long; middle flagellar segments broader than long; genal area little more than half as wide as eye, seen from side, lower part of genal area somewhat narrowed but, seen from side, more than half as wide as base of mandible. Surface sculpturing as described for male. Color yellow, the following markings black: facial fovea and longitudinal median line extending forward on frons from median ocellus, these connected by narrow transverse black mark through ocelli (forming a slender three-tined pattern as in *furfifera*); irregular black area on occiput; longitudinal line on notalus of scutum, beginning at anterior margin and extending about two-fifths of distance toward posterior margin; sutures between sclerites on dorsum of thorax and lower part of episternal groove; large U-shaped black mark on scutum consisting of black along posterior margin and longitudinal bar extending forward from near axilla to a point three-fifths of distance from rear edge to front edge of scutum, inner margin of this bar almost meeting black notalus; axillar fossa; spot (merely dusky in some paratypes) in center of scutum; lateral parts of metanotum; propodeal triangle and posterior face of propodeum (except two spots or a single larger spot in center of triangle); and lateral fovea of second tergum. Metasomal terga largely dark brown but bases of first five yellow (yellow in some cases hidden by telescoping of segments), brown areas not

reaching sides of metasoma so that margins of metasoma are yellow; apex of mandible and flagellum (yellowish beneath) reddish; outer margin of middle tibia (in some paratypes not obviously), outer margin of hind tibia, and hind tarsus dusky; wing color as in male. Pubescence as described for male.

TYPE MATERIAL: Holotype male, Dedari, Western Australia, 54-564 (A. Douglas), in the Western Australian Museum. Allotype female, Lake Grace, Western Australia, 51-2570 (A. Douglas), in the Western Australian Museum. One male paratype, same data as for holotype, but numbered 54-695 (A. Douglas). Two female paratypes (one without head, the other without metasoma), same data as for holotype, but numbered 54-571 and 54-741 (A. Douglas). Three female paratypes, Stirling Range, Western Australia, November 19, 1958 (E. F. Riek), in the collection of the Commonwealth Scientific and Industrial Research Organization. The specimens from Dedari were taken on mallee *Eucalyptus* flowers on January 20, 1954. The allotype was taken on December 20, 1954.

The specific name alludes to the dark markings which are much more extensive than those on other species of the genus.

***Stenohesma nomadiformis*, new species**

Plate 7, figures 4, 5; text figures 288-294

This slender, yellow-and-black species differs from all its relatives, such as *Holohesma semisericea*, *Stilpnosoma laevigatum*, and species of *Euryglossa*, *sensu stricto*, by the distinct yellow-and-black pattern as well as by the generic characters listed above.

FEMALE: Length, nearly 10 mm.; wing length, 6 mm. Relative measurements of head: width, 13.4; length, 11.6; clypeal length, 4.1; clypeo-antennal distance, 1.7; lower interocular distance, 8.5; upper interocular distance, 7.4. Apex of clypeus broadly truncate, truncation occupying about one-third of front margin of clypeus; profile of clypeus gently convex, apex a little below lower ends of eyes; upper margin, between subantennal sutures, concave; inner orbits parallel except for upper parts which converge above; scape reaching posterior ocellus; pedicel longer than first flagellar segment; flagellar segments except last subequal in length, slightly broader than long; interocular distance equal to

ocellocular distance, slightly greater than ocelloccipital distance; genal area about as wide as eye seen from side. Face below level of antennae shining, with scattered punctures of varying sizes; lower part of genal area also shining, with punctures of varying sizes separated by shining ground; face above antennae, vertex, and upper part of genal area finely and closely punctured, vertex with some larger punctures scattered among finer ones; scutum and scutellum with very coarse punctures separated by shining but minutely roughened ground (minute roughening more distinct, and punctures larger, than on clypeus), punctures separated by more than a puncture width on scutellum, by about a puncture width on much of scutum, but punctures along posterior, posterolateral, and anterior marginal areas of scutum fine and close; a few minute punctures scattered among large punctures of scutal disc; pronotum and metepisternum minutely and rather closely punctate; mesepisternum anteriorly like scutal disc, but large punctures somewhat smaller, posteriorly with punctures finer and closer; metanotum with punctures rather fine and close, like those of marginal areas of scutum; propodeal triangle shining, nearly smooth, impunctate; rest of propodeum with fine and rather close punctures anterolaterally, otherwise with only minute and widely separated punctures; first two terga sericeous and impunctate dorsally, laterally with small punctures; third and fourth terga dull, minutely roughened; fifth tergum with well-separated punctures; sterna with rather coarse punctures separated by finely roughened ground. Body, legs, and antenna yellow, sutures mostly marked with dark brown; facial fovea black; small area connecting ocelli, broad sublateral longitudinal band on scutum, axillar fossa, fossa on transverse metanotal suture, area lateral to propodeal triangle, propodeal pit and large area on mesepisternum in front of middle coxa, brown; broad longitudinal median zone of scutum reddish yellow, separated from brown bands by narrow yellow lines; flagellum reddish yellow; tegula translucent reddish yellow; legs, especially distally, slightly reddish; metasoma yellow, probably somewhat discolored, third and middle of second tergum darkened, bases of second to fourth terga broadly blackish

and blackish mediolateral area on first tergum; sterna 1 to 3 and base of sternum 4 largely black (possibly discoloration). Pubescence sparse, whitish, very short dorsally; fringe on pronotal lobe and hairs of anterolateral area of propodeum dense, obscuring surface; sixth tergum and posterior part of fifth with dense yellowish hair.

MALE: Length, 7.5 mm.; wing length, 5.5 mm. Relative measurements of head: width, 11.1; length, 9.7; clypeal length, 3.4; clypeo-antennal distance, 0.9; lower interocular distance, 6.1; upper interocular distance, 6.5. Agreeing with description of female except as follows: inner orbits converging below except for upper thirds which converge above; scape not reaching anterior ocellus; pedicel broader than long, shorter than any flagellar segment; first flagellar segment about as broad as long, others much longer than broad; ocelloccipital distance only half of interocellar distance; genal area much narrower than eye. Lower part of head with punctures coarser than in female, ground between them more roughened; scutal punctures rather close and not much coarser than largest punctures of vertex, much finer than those of clypeus; scutellum similar marginally but disc with coarser punctures separated by smooth shining ground; mesepisternal punctation finer than in female; metasoma with sterna and posterior terga less coarsely punctate than in female; seventh tergum flat, smooth, and shining dorsally with weak longitudinal median ridge. Coloration yellow, with dark brown sutures as in female, the following areas black (or on posterior part of thorax and metasoma dark brown): (1) large area on vertex and frons, mesial to facial foveae, above antennal bases, and in front of occiput, narrow yellow line left along inner orbit, broadened to small yellow area at summit of eye and abruptly broadened above antennal base; small yellow area between antennal bases and ocelli; (2) black along upper half of posterior orbit, extending back to occiput behind summit of eye and fusing there with 1; (3) occiput (except above) and posterior part of hypostomal area; (4) anterior half of dorsum of pronotum and line joining broad band along intersegmental suture below pronotal lobe; (5) propectus; (6) anterior side of anterior trochanter; (7) scutum except for broad yellow lateral area and separate broad midposterior

area; (8) axillar fossa, lateral part of metanotum, large dorsolateral area on propodeum, and propodeal pit; (9) large area in front of middle coxa, posterior thoracic venter, much of middle and hind coxae and trochanters, lower part of metepisternum and lower marginal zone of propodeum, connected along sutures to dorsolateral areas of propodeum and to area along upper part of mesepisternal-metepisternal suture; (10) transverse median, irregularly broken band on first tergum; (11) apical bands with sinuate anterior margins on first and second terga; (12) broad basal band on second tergum; (13) entire third tergum except lateral subapical yellow areas; (14) narrow basal band on fourth tergum; and (15) basal bands on third and fourth sterna, the band on third broad. Antenna yellow, with upper surface of flagellum (except first segment) and last two segments wholly brownish yellow; tegula and apical margins of fourth to sixth terga translucent reddish yellow. Pubescence as in female but without hair at apex of metasoma.

TYPE MATERIAL: Holotype female, Merunga, northern Queensland, January 20, 1927, in the Burns collection, to be deposited in the National Museum of Victoria. Allotype male, same locality, December 21, 1950, in the same collection as the holotype. One male paratype, Herberton, Queensland (no other data), in the Snow Entomological Museum of the University of Kansas. One male paratype, Edungalba, Queensland, December 6, 1940, in the collection of the Commonwealth Scientific and Industrial Research Organization. This last-mentioned specimen bears a type label and Rayment's manuscript name (in *Euryglossa*) based on Greek roots indicating yellow leaf.

The specific name alludes to the body form and the yellow-and-black coloration which suggest some of the species of *Nomada* (Anthophoridae) found in the Northern Hemisphere.

***Dasyhesma robusta*, new species**

Plate 7, figure 9; text figures 311-318

This species is related to *Euryglossa* (*Dermatohesma*) *abnormis* (Rayment) from which it differs in the characters listed at the beginning of the generic description. A noteworthy feature is the similarity of the sexes.

FEMALE: Length, nearly 8 mm.; wing

length, 5 mm. Relative head measurements: width, 12.7; length, 10.8; clypeal length, 4.4; clypeo-antennal distance, 1.3; lower interocular distance, 6.0; upper interocular distance, 8.5. Lower margin of clypeus truncate, well below lower ends of eyes; clypeus not protuberant, clypeus and lower two-thirds of supraclypeal area, as seen in profile, flat; antennal scape reaching anterior ocellus; interocellar distance greater than ocellocular distance and about three times ocelloccipital distance which is less than an ocellar diameter; median ocellus twice as far from antennal bases as from posterior edge of vertex (seen in profile); genal area less than half as wide as eye seen from side; malar area about half as long as width of mandibular base; antennal pedicel slightly longer than first flagellar segment which is a little longer than broad; second and third flagellar segments shortest, distinctly broader than long; middle flagellar segments broader than long. Clypeus shining, punctures large apically, finer basally, separated by little less than puncture width; genal areas, especially below and near eye, with punctation similar to that of upper part of clypeus; rest of head with punctures of same size but closer, so that surface seems less shining; scutum, scutellum, and mesepisternum with similar rather close punctures, coarser than those of upper part of head; metanotum more finely but closely punctate; metapleuron and sides of propodeum with fine punctation, moderately close on shining ground; side of pronotum broad, a broad concavity below and in front of posterior lobe, concavity impunctate but rest of surface with fine punctation; propodeal triangle minutely granular; posterior face of propodeum minutely roughened, with small scattered punctures; metasomal terga dull, minutely roughened, without punctures; sterna with distinct punctures on somewhat dull, minutely roughened ground. Head and thorax black or lower part of head and much of thorax dark brownish; antenna dark brown, third or fourth and following flagellar segments light brown beneath; legs brown, anterior tibia yellowish; wings slightly brownish, stigma yellowish brown, veins dark brown; metasoma dull, dark red, posterior margins of terga and sterna translucent and paler. Pubescence dull whitish, rather abundant, short on dorsum, longer on venter and on

legs, denser than elsewhere about antennal base, pronotal tubercle, and metanotum, obscuring surface and light yellowish brown on sixth tergum (except pygideal area) and posterior margin of fifth.

MALE: Length, nearly 7 mm.; wing length, 4.5 mm. Relative head measurements: width, 10.8; length, 9.5; clypeal length, 3.1; clypeo-antennal distance, 1.6; lower interocular distance, 4.9; upper interocular distance, about 8 (curvature of orbits such that one cannot easily decide where to make this measurement). Agrees with description of female except as follows: genal area, where shortest, about one-third as long as basal mandibular width; antennal pedicel distinctly longer than first flagellar segment; first two flagellar segments distinctly broader than long, middle flagellar segments as long as broad or longer than broad. Clypeal punctation similar to that of rest of face but coarser, like that of scutum; seventh metasomal sternum with distinct punctures and a longitudinal median impunctate ridge. Under surface of flagellum brown, darker than in female, the brown area extending to base of flagellum (unlike female). Pubescence somewhat longer on dorsum of head and thorax than in female, not dense on apex of metasoma.

TYPE MATERIAL: Holotype female, Pearce, Western Australia, 54-127 (A. M. Douglas), in the Western Australian Museum. Three female paratypes, same locality, two with numbers 54-125 and 54-126, the other dated January 1, 1956. Mr. Douglas writes that the numbered specimens were taken on January 6, 1954. Allotype male and four female paratypes, Capel, Western Australia, January 2, 1941. One female paratype, Bullsbrook, Western Australia, number 46-2576 (A. Douglas).

The specific name refers to the robust body form which is almost unique in the *Euryglossinae*.

Euryglossina (Euryglossina) intermedia,
new species

Plate 8, figures 5, 6; text figures 340, 350

This species is unique in having venation intermediate between that of *Turnerella* and that typical of *Euryglossina*. The second submarginal cell is complete as in *Euryglossina*, *sensu stricto*, but the second recurrent

vein is absent as it is from *Turnerella*. Its placement in *Euryglossina*, *sensu stricto*, is therefore arbitrary, but since *Turnerella* is a doubtfully valid subgenus, quite aside from this species, the subgeneric placement is a matter of no great consequence. The general size and form of *intermedia* are like those of such species as *E. flaviventris* and *personata*, but in the female *intermedia* lacks the yellow areas of those species, has the clypeal projections slender and widely separated (as in *hypochroma*), and has the antennal flagella longer and more slender with the middle segments broader than long but less than twice as broad as long.

FEMALE: Length, nearly 3 mm.; wing length, about 2.25 mm. Relative head measurements: width, 12.0; length, 10.8; clypeal length, 2.4; clypeo-antennal distance, 1.6; lower interocular distance, 4.0; upper interocular distance, 7.8. Clypeus sloping rather strongly, convex in profile, lower margin with two small projections separated by distance greater than interantennal distance; facial fovea less than half as long as eye; interocular distance slightly greater than ocellular distance, distinctly greater than ocellocipital distance; median ocellus more than three times as far from antennal bases as from posterior edge of vertex (seen in profile); genal area narrower than eye seen from side; pedicel as long as first three flagellar segments; middle flagellar segments wider than long; *second recurrent vein absent*. Body surface minutely roughened and with widely scattered, ill-defined, rather large punctures on clypeus, scutum, scutellum, and mesepisterna, and with larger, widely scattered punctures on metasomal sterna and posterior terga. Color black, with mandible (except tip) and anterior tibia and tarsus yellowish brown; antenna, other tarsi, and bases and apices of other tibiae brownish, infuscated; tegula dark brown posteriorly; small yellow streak along inner orbit below middle (in a few paratypes yellow line is lacking, in others it extends along whole lower three-fifths of inner orbit, and in a few there is a transverse diffuse yellow area across lower margin of supraclipeal area); wings clear, veins and margins of stigma dark brown, center of stigma light brown. Pubes-

cence pale, very sparse, short and inconspicuous dorsally and laterally except at apex of metasoma, scattered moderately long hairs on ventral surface (including clypeus) and on legs.

MALE: Length, about 2.75 mm.; wing length, 2 mm. Relative head measurements: width, 12.5; length, 10.8; clypeal length, 2.4; clypeo-antennal distance, 1.7; lower interocular distance, 5.7; upper interocular distance, 7.9. Lower clypeal margin broadly, gently concave; facial fovea shorter than ocellar diameter; interocular distance greater than ocellular distance and much greater than ocellocipital distance; genal area less than half as wide as eye seen from side; pedicel slightly longer than second flagellar segment, middle flagellar segments longer than broad. Wing venation, punctuation, and pubescence as in female. Black, with the following parts bright yellow: face below antennal bases (yellow extending up to form an obtuse angle between antennal bases, and laterally extending up to point on inner orbit one-fourth of distance from upper to lower end of orbit, margin of yellow notched near upper end by lower end of black facial fovea), scape, mandible (except dark brown apex), labrum, anterior extremity of hypostomal area and lower fourth of genal area, side of pronotum including lobe; posterior lateral extremity of propleuron, legs (except brownish mid and posterior tarsi and outer side of hind tibia and brownish spot on outer side of mid tibia), and anterior half of tegula. The following parts yellowish brown: pedicel and flagellum of antenna (infuscated above), posterior half of tegula, and metasomal venter.

TYPE MATERIAL: Holotype female, allotype male, and 17 female and three male paratypes, Wallangarra, southern Queensland, November 7, 1958, on *Leptospermum* (C. D. Michener), in the Queensland Museum, the paratypes in the Snow Entomological Museum of the University of Kansas and the collection of the Commonwealth Scientific and Industrial Research Organization.

The specific name refers to the venation of the forewing which is intermediate between that typical of the subgenus *Euryglossina* and that typical of the subgenus *Turnerella*.

Euryglossina (Euryglossella) perkinsi,
new species

Plate 8, figure 7

This species is similar to *E. cornuta* but differs in its slightly larger size, the almost entirely black coloration, the eyes which are divergent below in the female instead of slightly convergent as in *cornuta*, and in the angular projection of the head capsule below the lower end of the eye.

FEMALE: Length, about 2.5 mm.; forewing length, less than 2 mm. Relative head measurements: width, 11.8; length, 10.8; clypeal length, 1.9; clypeo-antennal distance, 2.1; lower interocular distance, 8.0; upper interocular distance, 7.5. Clypeus with strong sublateral projection as in *cornuta*; lateral to this projection clypeal margin is convex, anterior surface of this convexity smooth, shining, and concave; just lateral to end of clypeus, below middle of lower end of eye, is right-angled projection much shorter than clypeal projection; facial fovea fully half as long as eye; interocellar distance subequal to ocellular distance and slightly less than ocellocapital distance; median ocellus about twice as far from antennal bases as from posterior margin of vertex (seen in profile); genal area slightly narrower than eye seen from side; pedicel longer than first three flagellar segments together; middle flagellar segments much broader than long. Body not punctate but minutely roughened. Color black, clypeal projections, labrum, mandible (except apex), antenna, trochanters, front tibia, apices of other tibiae, and all tarsi dark yellowish brown, upper surface of flagellum infuscated; tegula dark brown, especially posteriorly; wings clear, veins and stigma brown, stigma very light except marginally. Pubescence pale, very sparse, the only conspicuous hairs being scattered ones near clypeal margin which exceed clypeal projections and hairs at apex of metasoma.

TYPE MATERIAL: Holotype female and two female paratypes, Binna Burra, near Lamington National Park, McPherson Range, southern Queensland, December 7, 1958, on *Claoxylon australe* (C. D. Michener), in the Queensland Museum, the paratypes in the Snow Entomological Museum of the University of Kansas.

This species is named for Mr. F. A. Perkins who arranged for my most interesting visit to Lamington National Park.

Brachyhesma (Microhesma) cooki, new species

Plate 8, figure 14

This species is close to *incompleta*, from the description of which it differs in the characters indicated below.

MALE: Relative head measurements: width, 13.9; length, 11.5; clypeal length, 1.6; lower interorbital distance, 7.7; upper interorbital distance, 8.9. First recurrent vein present in known specimens; anterior femur about half as wide as long; hind tibia with enormous bristle, robust basally, slender and downcurved in apical half, arising on under surface of tibia about three-fourths of distance from base to apex of tibia; hind basitarsus nearly as long as tibia.

TYPE MATERIAL: Holotype male and one male paratype, Botany Bay (near Sydney), New South Wales (H. Petersen), in the United States National Museum. The specimens also bear the label "C. F. Baker collection, 1927." The paratype lacks the head.

This species is named for Captain James Cook whose expedition obtained the first known bees from Australia.

Brachyhesma (Microhesma) dicaeta,
new species

Euryglossina hypoxantha RAYMENT, 1934, p. 202 (part).

This species agrees with the description of its close relative, *incompleta*, except as follows:

FEMALE: Length, 3.5 mm.; wing length, about 2.5 mm. Relative head measurements: width, 15.2; length, 13.5; clypeal length, 2.0; lower interorbital distance, 10.3; upper interorbital distance, 9.9. First recurrent vein present. Yellow ground color, especially on sides of thorax, paler than in *incompleta*; dorsum of head brown, down to level of lower ends of facial foveae; dorsal surface of thorax, including dorsal and posterior surfaces of propodeum, brown, infuscated posteriorly in holotype, only anterior margin of pronotum and anterolateral portions of scutum yellow; tegula (as in *incompleta*) translucent, with large yellow area anteriorly; darkening of legs less

strong than in *incompleta*; metasoma largely dark brown (possibly owing to discoloration; in a paratype there are basal yellow bands across terga, and the sterna and apical terga are largely yellow).

MALE: (Head missing from only specimen available). Wing length, less than 2.5 mm. Anterior femur about half as broad as long; middle femur less than twice as long as broad; hind tibia with two very long bristles or spurs, about as long as tibia, one arising on inner surface well before apex, the other near apex and on posterior side; hind basitarsus longer than tibia. Coloration of thorax brown dorsally as in female; metasoma largely brown dorsally, with narrow yellow basal bands of terga 2 to 4 showing through translucent apices of preceding terga; venter of metasoma yellow.

TYPE MATERIAL: Holotype female, Rott-nest Island, near Perth, Western Australia, 33-662, in the Western Australian Museum. The holotype was taken on flowers of *Mela-leuca* by L. Glauert in March, 1933, and is a paratype of *Euryglossina hypoxantha* Rayment, from which it differs strikingly by the characters noted in the discussion of the subgenus. One female paratype (metasoma gone), same locality, 34-1373, in the Snow Entomological Museum of the University of Kansas; one female paratype and the male allotype (head gone) on the same pin, same locality, 39-1288/9, in the Western Australian Museum. These specimens were taken by L. Glauert on flowers of *Leptospermum*, the first on March 10, 1934, the others on February 18, 1939.

The specific name refers to the two long bristles on the hind tibia of the male.

***Brachyhesma (Microhesma) incompleta*,
new species**

Plate 8, figures 12, 13; text figures 356-362

Euryglossa furcifera: COCKERELL, 1922a, p. 270 (misidentification).

This species is closest to *Brachyhesma cooki*, from which it differs most strikingly by the characters that are italicized below.

FEMALE: Length, nearly 4 mm.; wing length, 2.5 mm. Relative head measurements: width, 16.1; length, 12.7; clypeal length, 2.0; lower interorbital distance, 11.2; upper inter-

orbital distance, 10.2. Inner orbits near lower ends slightly converging below, elsewhere diverging below; clypeus medially about as long as diameter of antennal sclerite, anterior margin of clypeus broadly, gently emarginate medially; clypeus about 5.5 times as wide as median length; facial fovea long, linear, curved mesially almost to lateral ocellus; antennal scape about two-thirds as long as eye; pedicel longer than broad and longer than first two flagellar segments; flagellar segments all broader than long except for last which is much longer than broad, second flagellar segment shortest, about twice as broad as long; genal area widest just below middle of eye, considerably narrower than eye seen from side; interocellar distance equal to ocellocular distance and greater than ocellolocular distance; first recurrent vein absent (from 42 of 46 individuals). Body shining, with minute, widely scattered punctures, larger on lower part of face and on mesepisternum than elsewhere, denser on anterior part of scutum than elsewhere; surface between punctures minutely roughened (aciculate), hardly perceptibly so on lower part of face which is therefore more shiny than other areas. Head and thorax yellow, with rusty brown tints on dorsum of head and on scutum; facial fovea a slender black line; fissures between dorsal sclerites of thorax extensively blackened; propodeal triangle brownish black, with median yellow triangular area; mandible whitish, with black apex; antenna brown, under side of flagellum paler; legs yellow, distal segments of fore tarsi slightly brownish, other tarsi brown, outer sides of middle and hind tibiae slightly brownish, basitibial plate brown; metasoma yellow, with extensive ventral darkening, probably discoloring after death, and with broad basal and apical brownish black bands on terga (basal ones in some cases absent, perhaps discoloration), fourth and following terga largely dark; lateral foveae of second tergum brownish black. Wings transparent, veins and stigma pale translucent testaceous. Pubescence sparse, almost absent dorsally, white except for hairs of tarsi which are yellowish or, on hind tarsus, dusky.

MALE: Length, 3 mm.; wing length, slightly less than 2.5 mm. Relative head measure-

ments: width, 15.0; length, 13.0; clypeal length, 1.4; lower interorbital distance, 8.7; upper interorbital distance, 10.0. Inner orbits with upper portions slightly diverging below, lower portions distinctly converging; clypeus medially slightly longer than diameter of antennal sclerite and strongly convex seen in profile; anterior margin of clypeus broadly, gently convex; facial fovea long, linear, terminating near summit of eye and not curved toward ocelli; scape about two-thirds as long as eye; pedicel longer than broad and nearly as long as first three flagellar segments together; flagellar segments much broader than long except the last which is longer than broad, second to sixth flagellar segments about equally short, the second about twice as wide as long but the sixth more than three times as wide as long because of the thick flagellum which is widest from seventh to tenth segments, this portion of flagellum as well as eleventh segment flattened on lower surface; genal area widest below middle of eye, about two-thirds as wide as eye seen from side; ocellar positions and venation as in female; *anterior femur less than half as broad as long; longest bristles or spurs at apex of hind tibia not much longer than tibial diameter; hind basitarsus shorter than tibia*. Punctuation, coloration, and pubescence as in female except as follows: antenna yellow, flagellum brownish yellow; facial fovea brown, inconspicuous; yellow of propodeal triangle less extensive so that it is only broadly margined with brownish black; metasoma with sterna yellow, terga with broad, apical, brownish black bands, yellow bases of subapical segments exposed only when metasoma is abnormally extended.

TYPE MATERIAL: Holotype female and allotype male, Tamborine, southern Queensland, December 18, 1958, on flowers of *Angophora intermedia* (C. D. Michener), in the Queensland Museum. Four male and 35 female paratypes, same data, in the Snow Entomological Museum of the University of Kansas, the United States National Museum, and the collection of the Commonwealth Scientific and Industrial Research Organization. One additional female paratype, Samford, southern Queensland, January 1, 1959 (C. D. Michener), on *Eucalyptus*

tessellaris. Two males and two females were also taken at Capalaba, southern Queensland, December 27, 1958, on *Angophora woodsiana* (C. D. Michener).

Four females, not listed as paratypes but from the type locality, differ from the rest of the series in possessing the first recurrent vein; they thus agree in this striking feature with other species of the genus. The lack of that vein is a unique feature in bees, and the specific name is given in allusion to it even though an occasional individual has complete venation.

Hylaeus (Prosopistemon) cyaneomicans
(Cockerell)

This subgenus is new to New Guinea; hence the locality record for this and the following species seem worthwhile.

Port Moresby, Papua, April 25, 1959 (C. D. Michener), in the Bernice P. Bishop Museum.

Hylaeus (Prosopistemon) microphenax
(Cockerell)

Port Moresby, Papua, April 25, 1959 (C. D. Michener), in the Bernice P. Bishop Museum. These specimens differ slightly from Australian *microphenax* but are probably the same species.

***Hylaeus (Prosopistemon) albozebratus*, new species**

Plate 8, figure 17; text figures 394, 395

This small species is noteworthy for the extensive white maculations on all parts of the body. Morphologically it is quite like many small species of the subgenus.

MALE: Length, about 3.8 mm.; wing length, 3 mm. Relative head measurements: width, 17.0; length, 17.0; clypeal length, 7.0; clypeo-antennal distance, 2.4; lower interocular distance, 9.1; upper interocular distance, 11.0. Inner orbits converging below except for upper thirds which are subparallel; summit of clypeus narrow but considerably broader than interantennal distance; subantennal sutures distinctly diverging upward; malar space more than half as long as basal width of mandible; mandible of usual tapering form, with subapical tooth which is blunt and rounded; antennal scape not swollen but short, almost twice as long as broad, pedicel

slightly longer than broad; first and second flagellar segments about equal in length and much broader than long, third broader than long, middle flagellar segments almost as long as broad, only last segment distinctly longer than broad; genal area widest above middle of eye, about two-thirds as broad as eye seen from side; interocular distance distinctly greater than ocellocular distance which is greater than ocellocapital distance; second submarginal cell slightly more than half as long as first, first recurrent vein interstitial, second received just before end of cell; exposed sterna unmodified. Pale area of head impunctate, minutely vertically striate; rest of body dull, granular punctate, metasoma more finely so on anterior terga; metasomal sterna with irregular, rather coarse punctures on a slightly shining ground. Body black, with extensive white markings as follows: entire face below level of antennae, continuing up as broad band (as wide as antennocular distance) ending in irregular oblique truncation almost at summit of eye, white also continuing up from supraclypeal area as narrow line ending in white spot just below anterior ocellus; malar area; broad band along posterior orbit extending from malar area and mandibular base virtually to summit of eye; mandible except reddish brown apex; labrum; under surface of entire antenna (upper surface light brown); pronotum except black anterior part of dorsum and black band extending back to base of posterior lobe; broad longitudinal band on each side of midline of scutum; lateral margins of scutum (broad anteriorly); large spot on axilla; two large spots on scutellum; metanotum except laterally; tegula (except for transparent portions); wing bases; broad longitudinal median area extending from front to rear of mesepisternum, narrowly broken by black pre-episternal groove; legs except for black areas at bases of femora, extending nearly to apices of middle and hind femora and dark areas near middles of tibiae (reduced on fore tibia); first metasomal tergum except for black basal triangular area, dorsolateral blotch, and apical band; broad transverse median bands on second to fifth terga, that on third broken medially, on fourth and fifth with median notch on anterior side, band on fifth tergum with sublateral posterior emargination,

weakly indicated on other terga as well; last tergum apically; and second to sixth sterna with broad transverse white areas not reaching lateral extremities of sterna. Ground color of apical terga and sterna reddish; wings clear, veins and stigma brown. Pubescence very short, sparse, whitish.

TYPE MATERIAL: Holotype male, Carnarvon, Western Australia, September 2, 1953 (A. Snell), in the Western Australian Museum.

The specific name refers to the numerous white stripes on all parts of the body, a color pattern not found in the other species of the genus.

Hylaeus (Prosopistemon) douglasi, new species

Plate 8, figure 19; text figures 385-387

In its robust form this species resembles *H. simplex*. Although the latter is known only from the female and *douglasi* only from the male, it is entirely clear that they represent distinct species, for the latter is strongly punctate almost throughout and has red legs; these among other characters separate it from *simplex*, the resemblance to which is superficial.

MALE: Length, 7 mm.; wing length, about 5.5 mm. Relative head measurements: width, 13.0; length, 11.8; clypeal length, 5.2; clypeo-antennal distance, 1.3; lower interocular distance, 6.9; upper interocular distance, 7.6. Inner orbits converging below except for upper thirds which converge above; summit of clypeus slightly wider than interantennal distance; subantennal sutures diverging upward; malar space nearly 0.4 times as long as basal width of mandible; mandible widest at base, otherwise largely parallel sided, apex bidentate, shape therefore much like that illustrated for male of *tuamotuensis*; antenna short, not reaching front of tegula; scape not reaching anterior ocellus, three times as long as broad; second and third flagellar segments much broader than long; first and fourth to tenth slightly broader than long; eleventh longer than broad; genal area about as wide as eye seen from side, widest near level of middle eye; interocular distance slightly greater than ocellocular distance or ocellocapital distance; paraocular carina distinct along upper half of inner orbit; lower half of face and especially paraocular areas somewhat convex; lateral angle of pronotum dis-

tinct but posterior margin of pronotum arcuate upward mesial to angle, so that whole pronotal margin, between lateral angles, is biconvex; propodeal triangle, seen in profile, with dorsal surface larger than posterior surface, the dorsal surface flat anteriorly, then curving onto posterior surface; second submarginal cell more than half as long as first; first recurrent vein just beyond base of second submarginal cell; metasoma short and robust, first three terga large, remaining ones largely hidden; vertical face of first tergum with deep longitudinal groove; third sternum with large blunt projection at each side, projection somewhat flattened anteroposteriorly, anterior surface convex and hairless. Lower half of face shining, minutely roughened, and with small, widely separated, and irregular punctures; rest of head and thorax dull, with strong punctures; mesepisternum and posterior face of propodeum with very coarse punctures and small punctures in interspaces; propodeal triangle dull and rugose, coarsely and irregularly transversely so middorsally; first metasomal tergum with vertical face finely roughened and with scattered small punctures, absent in area of longitudinal groove; other exposed surfaces of terga coarsely rugosopunctate or irregularly punctate, more coarsely so on second and third terga than on first, with small punctures between coarse punctures or rugosities; posterior margins of terga shining, impunctate, and slightly elevated; sterna coarsely punctate. Black, lower half of face bright yellow, yellow not reaching clypeal margin or approaching mandibular base; yellow of supra-clypeal area extending but little above lower margins of antennal sockets; upper margin of yellow of paraocular area gently convex, reaching about level of upper margins of antennal sockets, not extending upward along eye margin; antenna dark brown, infuscated on upper surface and on scape, scape yellowish on under surface near base; dorsolateral angles of pronotum yellow; posterior lobes of pronotum yellow; small yellow spot near front of otherwise dark brown tegula; legs red, distal part of front femur and base of front tibia yellowish; wings brownish, veins and stigma black. Pubescence pale, light brown on vertex and thoracic dorsum, long and dense for a *Hylaeus*, especially ventrally.

TYPE MATERIAL: Holotype male, Morowa, Western Australia (50-4047, probably an error for 50-4447 according to Mr. A. Douglas), in the Western Australian Museum. If the interpretation of the number is correct, the specimen was taken in late September, 1950.

This species is named for Mr. Athol Douglas of the Western Australian Museum who has collected many bees and who helped me extensively during my visit to Perth.

***Hylaeus (Prosopisteron) simplex*, new species**

Plate 8, figure 18; text figure 434

This species is so unusual that at first sight it appears to represent a distinct genus or subgenus. It is robust like a female of *Euryglossa*, *sensu stricto*. The broad clypeus, nearly twice as broad as long, is a most unusual feature for a *Hylaeus*, as is also the short clypeo-antennal distance, slightly less than the diameter of an antennal socket. The long simple mandibles are also extraordinary; I know of no other similar mandibles among Australian *Hylaeus*.

FEMALE: Length, 8 mm.; wing length, about 5.5 mm. Relative head measurements: width, 16.0; length, 13.4; clypeal length, 5.5; clypeo-antennal distance, 0.6; lower interocular distance, 10.5; upper interocular distance, 9.8. Inner orbits parallel except for upper parts which converge above; clypeus very broad at level of mandibular bases, lateral margins above that level concave, summit of clypeus broader than interantennal distance; subantennal sutures diverging upward; malar space insignificant anteriorly; mandible long, tapering, only slight swelling representing usual subapical tooth; antenna with scape slender, nearly seven times as long as broad, reaching posterior ocelli; second flagellar segment much broader than long and last longer than broad, others about as long as broad, flagellum scarcely thicker apically than basally; genal area distinctly broader than eye, seen from side, broadest and forming rounded angle near lower end of eye; interocellar distance slightly less than ocellocular distance, subequal to ocelloccipital distance; dorsolateral angles of pronotum strongly produced, right-angled; propodeal triangle in profile entirely convex, about half of length might be considered to be dorsal surface, extreme base, medially, with pattern

of very short, longitudinal, slightly radiating carinae; second submarginal cell distinctly less than half as long as first, receiving first recurrent vein about one-sixth of length of cell beyond base. Lower half of face minutely vertically striate with scattered vertically elongate punctures, largest near lower margin of clypeus; hypostomal and genal areas also minutely roughened (but shining), and with scattered small punctures; frons and vertex with small punctures mostly separated by much less than a puncture width; thorax minutely roughened and with scattered minute punctures (absent on propodeal triangle); metasoma minutely roughened, anterior terga without noticeable punctures but posterior ones with small ones; sterna with more distinct punctures. Body black, propodeum and metasoma perhaps with very weak metallic tints in some lights; face with transverse band formed of three bright yellow spots of roughly equal size, one being the upper half of clypeus (lower margin of this yellow area irregular), the others being in paraocular areas; yellow of paraocular area gently convex above, not pointed on eye margin but highest midway between antennal base and eye margin where it reaches level of lower margins of antennal sockets, medially this yellow area reaches nearly to epistomal suture (but suture itself is black), below margin of yellow follows curvature of epistomal suture and then curves up along inner orbit, not closely approaching mandibular base; dorsolateral angle of pronotum broadly bright yellow; posterior lobe of pronotum bright yellow; distal half of front femur on posterior side bright yellow; basal half of front tibia and two-fifths of middle tibia, on outer sides, sloping to include only extreme base on inner side, bright yellow; basal half of hind tibia bright yellow; flagellum dark brown beneath; wings brownish, veins and stigma black. Pubescence exceedingly sparse, pale, some moderately long hairs on under side of all body regions.

TYPE MATERIAL: Holotype female, Merredin, Western Australia, October 20, 1947 (A. Douglas), in the Western Australian Museum. This locality is 160 miles east of Perth.

This species is so distinctive that it may ultimately form a separate subgenus or genus,

when the male is known. The specific name refers to the simple, untoothed mandibles.

Hylaeus (Prosopistemon) tuamotuensis,
new species

Text figures 391-393, 437, 438

This species comes from an entirely unexpected region, the Tuamotu Archipelago. The nearest point where species of the subgenus are known to occur is New Zealand, some 3000 miles to the southwest. A rich fauna of other species of the genus occurs in the Hawaiian Islands, about an equal distance to the northwest, but these belong to an entirely different subgenus, *Nesoprosopis*. The new species does not agree with any Australian species known to me. In Cockerell's (1910f) key it runs to 36 but is obviously completely different from the most similar species (*primulipictus*) keyed out under that number. The narrow lateral face marks, reaching only as high as the antennal bases, and the black supraclypeal area separate this species from *primulipictus*. *Hylaeus woyensis* and its undescribed relatives have similarly limited face marks but are very different in many other respects, including the dense, coarser punctation.

MALE: Length, 4 mm.; wing length, 3 mm. Relative head measurements: width, 7.3; length, 6.4; clypeal length, 2.7; clypeo-antennal distance, 0.9; lower interocular distance, 2.8; upper interocular distance, 4.7. Inner orbits strongly converging below except for upper parts which are subparallel; summit of clypeus slightly broader than interantennal distance; subantennal sutures diverging upward; malar space about one-third as long as basal width of mandible; mandible broadest at base but not much tapering, apex broad, strongly bidentate because of large, acutely pointed but broad, subapical tooth; antenna reaching scutellum, scape slender, about three times as long as broad, first two flagellar segments considerably broader than long, the second shortest, third slightly broader than long, fourth to tenth about as long as broad, eleventh longer than broad; genal area distinctly narrower than eye seen in side view; interocular distance subequal to ocellocular distance, somewhat greater than ocellocipital distance; second submarginal cell more than half as long as first, first

recurrent vein interstitial (or entering base of second submarginal cell). Face below antennae and genal and hypostomal areas minutely roughened with widely and irregularly scattered small punctures; above antennae face with coarser punctures separated by less than a puncture width; area between ocelli and eye nearly impunctate; thorax minutely roughened, fine well-separated punctures on scutum and scutellum, closer on sides of propodeum and in front of pre-episternal groove, coarser and well separated on mesepisternum behind pre-episternal groove; metasoma weakly lineolate, with widely scattered fine punctures. Black except as follows: mandibles (except for reddish apices), labrum, and clypeus (except for lateral margins of upper half) yellow; yellow on paraocular area reaching from mandibular base to level of antennal bases, not quite reaching epistomal suture above level of tentorial pit, tapering to point on eye margin above; prothorax with posterior lobe and broadly interrupted line on dorsoapical margin yellow; legs with apices of femora, anterior tibia except median area on posterior surface, middle tibia except median zone, nearly basal half and extreme apex of hind tibia, and all tarsi yellow; scape with small apical yellowish spot on under side; flagellum dark brown, paler beneath; tegula light brown except for anterior yellow spot; wings slightly brownish, with veins and stigma brown. (Yellow areas mostly reddened, probably by cyanide.) Pubescence short, sparse, pale, a few rather long apical hairs on clypeus.

FEMALE: Length, 4.5 mm.; wing length, about 3.6 mm. Relative head measurements: width, 8.0; length, 7.6; clypeal length, 3.2; clypeo-antennal distance, 0.8; lower interocular distance, 3.6; upper interocular distance, 5.0. Similar to male except for usual sexual characters and the following: summit of clypeus much broader than interantennal distance; malar space about one-fourth as long as basal mandibular width; first flagellar segment about as broad as long, second and third much broader than long, remaining segments slightly broader than long or about as long as broad except the last which is longer than broad; interocellar distance slightly greater than ocellocular distance. Surface sculpturing similar to that of male but scat-

tered punctures of lower half of face coarser. Mandible black except for yellow streak from base nearly to apex; labrum, clypeus, and scape black; paraocular area with rather slender whitish mark extending from base of mandible nearly to level of lower margins of antennal sockets, filling space between eye and clypeus below level of tentorial pit but widely separated from clypeus above; flagellum black above; thorax marked as in male; legs with apex of hind femur with little yellow; middle and hind tibiae with broad basal yellow zones only; tarsi brownish, especially apically.

TYPE MATERIAL: Holotype male and allotype female, Tukahora, Anaa Island, Tuamotu Islands, May 13, 1934 (E. C. Zimmerman), in the Bernice P. Bishop Museum.

A headless female, presumably of the same species, is from Boring Bay, Hao Island, Tuamotu Islands, May 18, 1934 (E. C. Zimmerman), in the Bernice P. Bishop Museum.

***Hylaeus (Edriohylaeus) ofarrelli*, new species**

Plate 8, figures 20, 21; text figures
369, 396-398, 459

This small, slender species differs from its relatives by the subgeneric characters listed above. The base of the metasoma of the female is red. An unusual feature of the male is the continuation of the pale color of the face through the malar areas and up the posterior orbits.

MALE: Length, about 3.7 mm.; wing length, 2.5 mm. Relative head measurements: width, 13.7; length, 11.8; clypeal length, 4.5; clypeo-antennal distance, 2.0; lower interocular distance, 7.0; upper interocular distance, 8.7. Inner orbits converging below except for upper subparallel portions; summit of clypeus about as broad as interantennal distance; subantennal sutures slightly diverging upward; malar space more than one-third as long as basal width of mandible; mandible of usual tapering form, apex bidentate (i.e., with large subapical tooth); antenna long, reaching propodeum, first flagellar segment slightly broader than long, second segment nearly twice as long as broad, remaining segments of about the same length but progressively thicker toward apex; genal area little more than half as wide as eye seen in side view; interocellar distance greater than ocel-

ocular distance and about twice ocellocipital distance; second submarginal cell about half as long as first, receiving recurrent veins almost at its ends (or first recurrent entering first submarginal cell); metasoma very slender as in *Heterapoides*. Pale area of head with minute, widely separated, ill-defined punctures on shining but minutely roughened ground; hypostomal and lower genal areas shining; rest of head and thorax, including propodeum, with surface closely roughened or punctate, rather dull; metasoma minutely transversely roughened, more shining. Black, face marks white below, becoming yellow above; pale areas on head include clypeus, labrum, supraclypeal area to slightly above level of lower edge of antennal sockets, parocular area (upper end of yellow extending from point on eye margin one-fifth of eye length below summit of eye to antennal socket), malar area, mandible (except reddish apex), and broad band extending from malar area and mandible nearly halfway up posterior eye margin; under sides of scape and pedicel yellow, flagellum pale brown beneath, dark brown above; posterior dorsal margin and posterior lobe of pronotum and spot on otherwise translucent testaceous tegula yellow; legs yellow (including coxae), with blackish streak on posterior side of front and middle femora and tibiae (small on front tibia) and with hind femur black except for base and apex and hind tibia with black postmedian band; distal segments of tarsi, especially of posterior tarsus, somewhat darkened; posterior margins of first two (and sometimes other) metasomal terga brownish; wings nearly clear, with veins and stigma dark brown. Pubescence very short, sparse, whitish, a few long subapical bristles on clypeus.

FEMALE: Length, about 3.8 mm.; wing length, 3 mm. Relative head measurements: head width, 17.7; length, 14.3; clypeal length, 6.0; clypeo-antennal distance, 2.2; lower interocular distance, 9.6; upper interocular distance, 11.0. Similar to male except for usual sexual characters and the following: summit of clypeus broader than interantennal distance; subantennal sutures parallel; malar space short anteriorly, less than one-third as long as mandibular width; flagellar segments mostly broader than long, second shortest, ninth about as long as broad, tenth longer; genal area broadest below middle of eye,

broader than eye seen from side; interocular distance slightly less than ocellocular distance and distinctly more than ocellocipital distance; metasoma relatively robust as in *Prosopistemon* although third segment often widest. Surface sculpturing similar to that of male but finer, dorsum of thorax with scattered minute punctures visibly different from fine roughening between them. Head markings limited to whitish streak along lower inner orbit; labrum, mandible, and lower margin of clypeus reddish brown; all antennal segments yellowish brown beneath, brownish black above; thorax (including tegula) black except for posterior pronotal lobe; legs reddish brown, with coxae (except apices), femora (except apices), and broad postmedian areas on mid and hind tibiae blackish; first two metasomal segments reddish brown, the second with broad blackish areas laterally.

TYPE MATERIAL: Holotype male, allotype female, and four male paratypes, Binna Burra, near Lamington National Park, McPherson Range, southern Queensland, December 7, 1958, on flowers of *Claoxylon australe* (C. D. Michener). Three female paratypes, Armidale, New South Wales, reared in November, 1958, from a nest in dead dry stem of *Verbena bonariensis* (C. D. Michener). (The nest was associated with nests of *Exoneura lawsoni*.) One male and three female paratypes (all on one pin, only head of male preserved, metasoma of one female gone), Deepwater, New South Wales, reared in November, 1958, from a nest in a dry dead reed (C. D. Michener). The holotype and allotype are in the Queensland Museum; the paratypes, in the collection of the Commonwealth Scientific and Industrial Research Organization and the University of Kansas.

This species is named for Prof. A. P. O'Farrell of the University of New England who made possible my trip to the New England Plateau of New South Wales where the sexes of this species were associated by rearing from a single nest. They are so different in appearance that they would not have been readily associated otherwise.

***Hylaeus (Hylaeteron) hemirhodus*, new species**

Plate 9, figures 3; text figures 407, 435

This species is most similar to *semirufus* but differs in having the lateral face marks

pointed above (not truncate at level of antennae as in *semirufus*), by the more coarsely areolate dorsum of the propodeum, with an irregular carina consisting of the posterior margins of the larger areolae separating the dorsal from the posterior propodeal surface, and by the somewhat smaller stigma (less than two-thirds as long as costal edge of marginal cell; it is more than two-thirds this length in *semirufus*). The free part of the marginal cell is nearly twice as long as the rest in *semirufus*; in *hemirhodus* it is only somewhat more than one and one-half times as long as the rest.

FEMALE: Length, 6 mm.; wing length, 4 mm. Body robust for a *Hylaeus*. Relative head measurements: width, 12.0; length, 10.1; clypeal length, 5.0; clypeo-antennal distance, 0.3; lower interocular distance, 7.0; upper interocular distance, 7.2. Inner orbits scarcely converging below; clypeus convex, broad, upper margin convex, broader than interantennal distance, more than twice antennocular distance, subantennal suture almost absent because clypeus so closely approaches antennal socket; malar area about one-fourth as long as basal width of mandible; mandible nearly 2.5 times as long as broad, broadest at base, tapering toward tridentate apex; scape short and slender, reaching only about halfway from base to anterior ocellus; pedicel little less than half as long as scape; flagellum short, first segment about as long as broad, second much broader than long, remaining segments progressively longer, several of distal segments being longer than broad; supraclypeal area triangular, raised, but upper end sloping to level of frons, not abruptly cut off; genal area widest slightly below middle, more than half as wide as eye seen from side; interocellar distance greater than ocellocular distance, subequal to ocellocipital distance; second submarginal cell more than half of length of first. Face below antennae with coarse, ill-defined, shallow punctures separated by irregularly and mostly transversely roughened ground; rest of head mostly closely punctured, punctures somewhat elongated on lower paraocular areas and coarse and separated by shining but minutely roughened ground on hypostomal areas; facial fovea distinct and linear as in most *Hylaeus*; scutum and scutellum almost as closely punctured as dorsum of head but

distinctly more finely so; mesepisterna with large, well-separated punctures, ground between them finely roughened; metanotum finely and closely punctured; dorsal and dorsolateral parts of propodeum with coarse carinae forming coarse areolation, areolae shining; there is an irregular transverse carina near base and another at middle of apex of subhorizontal part of propodeum, other carinae define areolae of irregular shapes and varying sizes; lateral margins of posterior surface of propodeum defined by carinae which diverge strongly upward until they reach dorsolateral areolar areas; rest of propodeum with rather fine, well-separated punctures; metasomal terga with punctures about as large as those of scutum, those of first tergum separated by more than a puncture width middorsally, by less laterally and premarginally, margin impunctate, surface shining; remaining terga with punctures progressively larger and less well defined and surface between them including impunctate margins progressively duller and more coarsely roughened. Head and thorax black, the following parts yellow: mandibles except dark apices, clypeus except lateral brownish suffused areas, paraocular areas below irregular line sloping at 45-degree angle from dorsolateral corner of clypeus along antennal socket and thence to point near eye margin a little above middle of inner orbit, triangular supraclypeal area with upper end truncated. Antenna, small area behind mandibular base, legs except coxae, and metasoma red. Wings transparent, veins and stigma light brown. Pubescence very short and sparse, dull whitish.

TYPE MATERIAL: Holotype female, Wotjulum, northern Western Australia, October 12, 1955 (A. Douglas), in the Western Australian Museum. Mr. Douglas writes that the specimen was taken on flowers of *Grevillea*, and that Wotjulum is near Yampi, west of Derby.

The specific name refers to the half-red body, the head and thorax being predominantly black in contrast to the red metasoma.

***Hylaeus (Euprosopoides) perconvergens*,
new species**

Plate 10, figure 2; text; figures 418-420

This species is extraordinary in the completely black clypeus of the male, contrasting with the yellow paraocular and supraclypeal areas, and in the strongly convergent lateral

margins of the clypeus which almost meet above, the summit of the clypeus being only about half as wide as an antennal socket. Except for the characters mentioned, the species is rather similar to *H. obtusatus*.

MALE: Length, 8.5 mm. (varying to 7.5 mm.); wing length, 6 mm. (varying to 5 mm.). Relative head measurements: width, 13.2; length, 12.8; clypeal length, 5.6; clypeo-antennal distance, 1.5; lower interocular distance, 6.0; upper interocular distance, 7.6; width of upper end of clypeus (=distance between lower ends of subantennal sutures), 0.5. Inner orbits strongly converging below except for subparallel upper portions; lateral margins of clypeus strongly converging upward, summit of clypeus about one-third as broad as interantennal distance and less than half as broad as diameter of antennal socket; supraclypeal area equally narrow at lower end, gradually elevated toward upper end which is expanded, subtruncate and which is abruptly declivous to the level of rest of face; paraocular area with broadly elevated low ridge surrounding antennal socket below and laterally; median length of malar area less than half of basal width of mandible; mandible more than twice as long as broad, broadest basally, with large subapical tooth; antennal scape rather flat and somewhat broadened, broadest subapically, more than twice as long as broad; first flagellar segment broader than long, second as broad as long, others longer than broad; genal area narrower than eye seen from side, widest slightly above middle of eye; interocellar distance equal to ocellocular distance, greater than ocelloccipital distance; second submarginal cell rather long but, because of generally elongate wing, less than two-thirds as long as first. Head and thorax rather dull because surface mostly finely roughened between punctures; punctures of clypeus and lower paraocular area longitudinally elongate; upper yellow part of paraocular area and supraclypeal area finely and sparsely punctured, with rather large impunctate areas; upper (black) part of supraclypeal area and central part of frons closely and rather coarsely punctate, vertex and genal areas more finely so; thorax with rather coarse punctures, mostly separated by less than a puncture width; metepisternum subhorizontally striate; lateral part of propodeum finely punctate;

propodeal triangle areolate, dorsal surface more than half as long as metanotum, concave, margined posteriorly by strong carina, and traversed by a few irregular longitudinal ridges; metasomal terga punctured throughout, more finely so near posterior margins of terga, punctures separated by less than a puncture width; sterna, especially second and third, more coarsely and sparsely punctured. Body black, distal terga feebly bluish green; under side of flagellum brown; the following parts bright yellow: paraocular area up to diagonal line which slants upward mesially from point on orbit opposite middle of antennal socket to point just above antennal socket, so that yellow surrounds socket laterally; supraclypeal area; basal lateral streak on scape; posterior lobe of pronotum (in one paratype minute spot on each side of middle of posterior dorsal edge of pronotum); broad transverse area on scutellum, reaching posterior margin but anterior part of scutellum black, yellow protruding forward medially; median third of metanotum, the metanotal yellow area reaching both anterior and posterior margins and not extending laterally as far as yellow of scutellum. Wings slightly grayish, veins and stigma dark brown. Pubescence short, inconspicuous, dull whitish, fuscous on vertex and apical metasomal segments.

TYPE MATERIAL: Holotype male and two male paratypes, Bunbury, Western Australia, January 20, 1956 (A. Snell); one male paratype, same data but dated merely January, 1956. One male paratype, Capel, Western Australia, January 18, 1957 (A. Snell). The holotype is in the A. N. Burns collection, to be deposited in the National Museum of Victoria; the paratypes are in the National Museum of Victoria and the Snow Entomological Museum of the University of Kansas.

The specific name refers to a character which is unique among all the bees, namely, the convergence upward of the sides of the clypeus to an exceedingly short margin between the lower ends of the subantennal sutures.

***Hylaeus (Pseudhylaeus) multigibbosus*,**
new species

Plate 10, figures 6, 7

This species is superficially similar to *H. (P.) albocuneatus* from which it differs by the

presence of shining convexities or projections on the third to fifth sterna of the male. The female is very similar to that of *albocuneatus* but the cream-colored mark of the paraocular area, at its upper mesial angle, is little if any above the summit of the clypeus, whereas in *albocuneatus* it is above the level of the summit of the clypeus and reaches the antennal sclerite.

MALE: Length, 6.5 mm. (varying to nearly 7 mm.); wing length, 5 mm. Relative head measurements: width, 11.0; length, 8.6; clypeal length, 3.3; clypeo-antennal distance, 1.0; lower interocular distance, 5.4; upper interocular distance, 7.0. Inner orbits strongly converging below except for subparallel upper portions; clypeal surface broadly concave along longitudinal axis; lateral margins of clypeus strongly converging upward, summit of clypeus slightly narrower than interantennal distance, subantennal sutures diverging upward; malar area essentially linear; mandible more than twice as long as basal width, much the broadest at base, with subapical tooth; antenna short and robust, scape little more than twice as long as broad, flagellum with first and last segments about as long as broad or slightly longer, other flagellar segments all much broader than long, the second being the shortest, much more than twice as broad as long; genal area widest scarcely above middle of eye, slightly narrower than eye seen in side view; interocellar distance subequal to ocellocular distance and nearly twice ocelloccipital distance; second submarginal cell more than half of length of first; second metasomal sternum with posterior edge broadly emarginate medially; third with two large tubercles or convexities, one on each side; fourth with a transverse shining ridge about as high as convexities of third; fifth with similar but lower ridge. Body surface dull, spaces between punctures finely roughened; clypeus not striate, rather closely punctate, punctures separated by less than a puncture width; lower lateral portions of clypeus with punctures close, elongate in an oblique direction, paraocular areas with punctures of various sizes, some of them similarly elongate, giving a strigose appearance; supraclypeal area and median part of frons finely longitudinally striate; frons and vertex with rather close punctures, finer than those of clypeus; scutum and scutellum with still finer

punctures; sides of thorax with punctures about as coarse as those of clypeus but shallower; propodeum weakly roughened basally, the roughening not reaching posterior end of sloping dorsal surface and fading away into the finely roughened rest of the propodeal surface; sloping dorsal surface of propodeum less than half as long as vertical posterior surface; metasomal terga finely granular, last three more distinctly punctate. Body dull black, the following parts cream colored: clypeus except for black apical margins; square lower part of supraclypeal area; paraocular area up medially to lower edge of antennal socket, laterally to broad summit midway between antennal base and ocelli, margin of pale area following antennal socket so that latter forms concavity in margin of pale area; broadly broken line on posterior margin of pronotum; pronotal lobe; spot on otherwise translucent testaceous tegula; anterior surfaces of front and middle femora; apex of hind femur; front tibia except area on posterior side; base and anterior surface of middle tibia; basal half of hind tibia; and tarsi (small segments of tarsi brownish; some of other areas on legs more yellowish brown than cream colored). Posterior margins of metasomal terga and tibial spurs translucent whitish. Wings clear, veins and stigma brown, the former rather light. Pubescence whitish.

FEMALE: Length, 6.5 mm. (varying to 5.5 mm.); wing length, 4.6 mm. (varying to 4 mm.). Relative head measurements: width, 11.5; length, 9.5; clypeal length, 4.0; clypeo-antennal distance, 0.5; lower interocular distance, 7.0; upper interocular distance, 7.6. Similar to male except for usual sexual characters and the following: inner orbits less strongly converging below; summit of clypeus distinctly broader than interantennal distance; mandible about three times as long as basal width; antenna short but much more slender than that in male; scape more than four times as long as broad, shortest flagellar segments (second and third) less than twice as long as broad. Clypeus and supraclypeal area longitudinally striate, punctures elongate and almost obscured by striation. Clypeus and supraclypeal area black; paraocular area with cream color medially reaching only to level of summit of clypeus, not reaching antennal sclerite, lateral extremity pointed on eye margin at level of upper edge of antennal

sclerite; front and middle femora with cream color only at apices; hind femur entirely blackish; front tibia cream colored on outer and anterior sides nearly to apex; middle and hind tibiae cream colored basally; tarsi dark brown, distal segments paler.

TYPE MATERIAL: Holotype male, allotype female, and one male paratype, Canberra, Australian Capital Territory, November 3, 1946 (E. F. Riek), in the collection of the Commonwealth Scientific and Industrial Research Organization. Two female and one male paratypes, same data, but taken October 26, 1946, in the Snow Entomological Museum of the University of Kansas. One male paratype, Jondaryan, southern Queensland, October 20, 1958 (C. D. Michener), in the Snow Entomological Museum of the University of Kansas. This last-mentioned specimen and probably the others were taken on flowers of *Wahlenbergia*.

The specific name refers to the several shining convexities or gibbosities on the under side of the metasoma of the male.

Hylaeus (Xenohylaeus) rieki, new species

Plate 10, figures 10, 11; text-figures
373, 449-451, 454

This species is related to *H. kelvini* but differs in the paler yellow markings, the elongate ovate scape of the male, the narrow summit of the clypeus in the male, the less turgid-appearing pronotum of both sexes, the yellow lower paraocular areas of the female, the small size of the leaflike setae on the dorsoapical lobes of the eighth sternum of the male, the less coarsely rugose propodeal triangle, and many other characters.

MALE: Length, 6 mm. (varying to 7 mm.); wing length, 4.75 mm. (varying to 5 mm.). Relative head measurements: width, 11.9; length, 11.0; clypeal length, 3.6; clypeo-antennal distance, 2.7; lower interocular distance, 5.2; upper interocular distance, 7.2. Eyes distinctly converging below except for upper parts which are parallel; lateral margins of clypeus strongly converging upward to summit of clypeus which is only about as wide as diameter of middle of antennal flagellum; subantennal sutures diverging upward; malar area nearly half as long as basal width of mandible; mandible less than three times as long as broad, with large subapical tooth;

upper half of supraclypeal area with strongly protuberant median longitudinal elevation; antennal scape broad, flattened, concave behind, almost twice as long as broad, a rounded apex surpassing base of pedicel; first and second flagellar segments broader than long; facial depressions broad, divided by oblique ridge extending from antennal socket toward upper end of eye; genal area widest above middle, little more than half of eye width as seen from side; interocular distance subequal to ocellocular distance, greater than ocellocipital distance; second submarginal cell rather long but less than two-thirds as long as first; genitalia and hidden sterna as shown in figures. Body surface dull, spaces between punctures minutely roughened; clypeus with rather large, longitudinally elongate punctures, sparse along midline, ground between them minutely longitudinally striate; facial depression (which occupies whole paraocular area) minutely and mostly longitudinally roughened, dull; upper frons finely and closely punctate, vertex more coarsely so, genal areas rugose punctate; dorsum of thorax finely punctate (much more finely so than vertex), punctures separated by less than (usually half of) a puncture width of roughened ground; sides of thorax with punctures coarser, often separated by nearly a puncture width of roughened ground; propodeum with dorsal surface sloping, narrower than metanotum, rounding onto posterior surface, coarsely and irregularly rugose, this sculpturing grading into the dull, granular, posterior surface; first three metasomal terga with small punctures separated by more than a puncture width dorsally, laterally punctures coarser and separated by less than a puncture width, ground between punctures roughened and very dull; remaining terga somewhat more coarsely punctate and more shiny although ground roughened; posterior margins of all terga narrowly shining; sterna more coarsely punctate, shining although ground roughened; third sternum with strong, transverse, shining, weakly recurved basal ridge on middle half of exposed part of sternum (i.e., absent on lateral fourth); fifth sternum with margin broadly concave and with long fringe of light brown hairs. Body and appendages black or brownish black except as follows; clypeus (except narrow lateral brown area below

tentorial pit), mark on basal half of mandible, paraocular area below level of antenna, spot at lower end of supraclypeal area, anterior surface of front tibia, spots on distal half of anterior surface of front femur, interrupted line across summit of pronotum, and posterior lobe of pronotum pale yellow; front tibia and tarsus (except for yellow area on tibia) brown; posterior side of scape yellowish, lower two-thirds of anterior surface yellowish brown; lower surface of antennal segments 2 to 9 yellowish brown; anterior tibial spurs yellowish brown, middle and posterior ones whitish; wings light brown, veins and stigma dark brown. Pubescence white, in some cases light fuscous on vertex, light fuscous on apical terga; hairs of lower part of supraclypeal area very long and forming two slender tapering pencils directed downward and laterally in approximately directions of lateral parts of epistomal suture; pubescence of scutum, scutellum, and dorsum of metasoma very short, that of posterior parts of first three metasomal terga directed sublaterally.

FEMALE: Length, 6.5 mm. (varying to 8.5 mm.); wing length, 4.6 mm. (varying to 5.3 mm.). Relative head measurements: width, 12.1; length, 11.8; clypeal length, 4.2; clypeo-antennal distance, 1.8; lower interocular distance, 5.8; upper interocular distance, 7.3. Structure similar to that described for male except for usual sexual characters and the following: summit of clypeus not so narrowed as in male, almost as wide as paraocular area at same level; lower parts of subantennal sutures parallel, only upper extremities diverging upward; clypeus with very fine longitudinal median carina. Punctuation similar to that of male; clypeal punctures not sparse medially; paraocular areas except above finely, longitudinally striate with fine, scattered, longitudinally elongate punctures; supraclypeal area also longitudinally striate, like clypeus below, more coarsely so above, with longitudinally elongate punctures except in lower median part; punctuation of apical metasomal terga not appreciably different from that of first three. Coloration as in male but clypeus, mandibles, and supraclypeal area black; antenna black, brownish black on under surface; paraocular area yellow below level of antennal base, as in male but summit of yellow area convex, the black extending

down along eye margin for short distance; front leg brownish black, with yellowish brown area on front surface of tibia. Pubescence as in male but very short on supraclypeal area, blackish on fourth and following terga and fifth and following sterna, white and directed sublaterally on posterior parts of first four terga.

TYPE MATERIAL: Holotype male and one male paratype, Canberra, Australian Capital Territory, October 21, 1946 (E. F. Riek). Allotype female, same data, but October 15, 1946. Two female paratypes, same data, but November 28, 1946. Two male paratypes, Black Mountain, Australian Capital Territory, October 2, 1931 (L. F. Graham). The type material is in the collection of the Commonwealth Scientific and Industrial Research Organization, except for two paratypes which are in the Snow Entomological Museum of the University of Kansas.

This species is named for Dr. E. F. Riek of the Commonwealth Scientific and Industrial Research Organization, not only in recognition of him as collector of most of the type material, but also because he has worked hard to make available to me much important material on bees, including many types.

***Hylaeus (Zenohylaeus) scutaticornis*, new species**

Plate 10, figures 8, 9; text figure 453

This species is closely related to *H. rieki* but differs from the description of that species as indicated below.

MALE: Length, 6.5 mm.; wing length, 5 mm. Relative head measurements: width, 11.5; length, 11.6; clypeal length, 4.0; clypeo-antennal distance, 2.6; lower interocular distance, 5.0; upper interocular distance, 7.2. Differs from description of *H. rieki* as follows: subantennal sutures less strongly diverging upward; malar area more than half as long as basal width of mandible; lower tooth of mandible expanded on lower margin so that mandible is broadened subapically; supraclypeal area convex but not strongly protuberant above; scape about twice as long as broad, pedicel attached at apex; second flagellar segment broader than long, others longer than broad; second submarginal cell nearly two-thirds as long as first. Facial depressions more shining than in *rieiki*; dorsum of thorax more finely punctured; ridge of

third sternum straight, on middle third of exposed width of sternum. Yellow markings deeper yellow than in *rieki*; lateral margins of clypeus below tentorial pits broadly black; mandible without yellow (small basal yellow dot in paratype); upper margin of yellow of paraocular area deeply concave between slender projection along margin of antennal socket and slender projection near inner orbit; supraclypeal area with yellow band extending up nearly to level of antennal bases; inner surface of front femur with yellow only at apex but outer surface with large ventral yellow area in distal half; anterior surface of scape yellow only along outer edge; front tarsus nearly black. Pencils of hair from supraclypeal area separated basally by yellow area (not meeting basally above yellow as in *rieki*).

FEMALE: Length, 6.5 mm.; wing length, 5 mm. Relative head measurements: width, 12.6; length, 12.7; clypeal length, 5.1; clypeo-antennal distance, 2.0; lower interocular distance, 6.2; upper interocular distance, 8.0. Subantennal sutures weakly diverging above. Fifth and sixth metasomal terga more shiny than preceding terga. Yellow areas brighter than in *rieki*, yellow of paraocular area truncate at level of antennal base; small yellow spot at base of front tibia.

TYPE MATERIAL: Holotype male, allotype female, and one male paratype, Cotton Vale, southern Queensland, September 29, 1958 (C. D. Michener), on flowers of *Daviesia corymbosa*. The holotype and allotype are in the collection of the Commonwealth Scientific and Industrial Research Organization; the paratype is in the Snow Entomological Museum of the University of Kansas.

The specific name alludes to the shieldlike scape of the antenna.

***Gephyrohylaeus sandacanensis* (Cockerell)**

Plate 11, figures 1, 2; text figures 461-464

This species has previously been known only from Borneo. It occurs also in New Guinea, both at sea level and in the highlands, and presumably is found also on the intervening islands. The New Guinea collecting data are: Korifeigu, 15 miles southeast of Goroka, Northeast New Guinea, altitude 5000 feet, May 1, 1959 (C. D. Michener); Port Moresby, Papua, April 25 and May 11, 1959 (C. D.

Michener), in the Bernice P. Bishop Museum and the Snow Entomological Museum of the University of Kansas.

***Hylaeorhiza burnsi*, new species**

Plate 11, figure 7; text figure 484

This is another large black hylaeine with the scutellum and metanotum yellow. The most distinctive feature of *H. burnsi* is the large, broad head, with genal areas much broader than the eyes, with the clypeus much broader than long, with large mandibles having an oblique edge between the two teeth, and with the yellow limited to the paraocular areas below the level of the antennal bases. In all these respects *burnsi* is completely different from *nubilosa* and other species of the genus; as indicated above, *burnsi* may be placed in another genus when the male is known.

FEMALE: Length, 12 mm.; wing length, 8 mm. Relative head measurements: width, 19.1; length, 16.2; clypeal length, 6.2; lower interocular distance, 12.7; upper interocular distance, 11.0. Eyes slightly diverging downward except upper parts which diverge distinctly; malar area about one-fifth as long as basal mandibular width; mandible narrow medially, broadened subapically, subapical tooth a broad angle separated from apex of mandible by oblique margin; genal area nearly twice as wide as eye seen from side; interocellar distance distinctly less than ocellocular distance, more than half of ocellocipital distance; second submarginal cell more than half as long as first, considerably longer on posterior than on anterior margin and distinctly longer than in *nubilosa*. Lower half of face with minute punctures separated by several puncture widths on shining but minutely roughened ground; clypeus with subapical transverse depression broken medially; genal and hypostomal areas similar to lower half of face but punctures a little coarser; mesepisternum laterally also similar but with punctures of two sizes intermixed, larger ones about size of those of genal area; mesepisternum ventrally with coarser punctures of two sizes; posterior lobe of pronotum turgid, smooth, shining; scutellum smooth, shining, except for scattered minute punctures; metanotum minutely roughened with scattered minute punctures; frons, vertex, and scutum

rather finely punctate, punctures separated by about half of a puncture width, those of upper paraocular areas of two sizes and vertically elongate; metepisternum transversely striate; propodeum dull, triangle impunctate, rest with punctures about size of those of scutum but separated by a puncture width or more; metasomal terga more finely punctate than scutum, more finely so toward apex of metasoma; sterna more coarsely punctate. Black, flagellum dark brown, lighter beneath; paraocular area below level of antennal bases entirely bright yellow; posterior pronotal lobe, scutellum (except laterally), and metanotum (except laterally) bright yellow; tarsi slightly brown; wings nearly clear, brownish along costal margin beyond stigma; stigma black; veins brownish black. Pubescence very short and sparse, fuscous on front, vertex, and scutum (nearly absent from scutum), black or fuscous on dorsum of metasoma (nearly absent from first four terga) and on fifth and sixth sterna.

TYPE MATERIAL: Holotype female and one female paratype, Bellbird, Victoria, February 28, 1934, in the Burns collection to be deposited in the National Museum of Victoria.

This species is named for Mr. A. N. Burns of the National Museum of Victoria.

***Palaeorhiza (Palaeorhiza) conica*, new species**

Text figures 472, 495, 498

This is a large species, with a black-and-yellow head and thorax, a dark green metasoma, red legs, and a prominent conical projection with a rounded apex on the propodeal triangle. The edentate mandibles suggest *P. (Anchirhiza) mandibularis* but are more slender, as in other species of the genus.

FEMALE: Length, 11 mm.; wing length, 9.5 mm. Relative head measurements: width, 16.5; length, 15.5; clypeal length, 7.5; lower interocular distance, 8.6; upper interocular distance, 8.9. Eyes converging below except at upper extremities where they converge toward ocelli; malar area slightly longer than basal width of mandible; mandible about three times as long as broad, apex edentate; genal area as broad as eye seen from side; interocellar distance about half of ocellocular distance and scarcely more than length of ocellar diameter, much less than ocellocipital distance; propodeal triangle forming high,

rounded projection; second submarginal cell more than two-thirds as long as first; inner hind tibial spur, on inner margin, coarsely serrate with about 14 teeth; second to fourth anterior tarsal segments flattened, inner apical lobe exceeding outer. Clypeus finely longitudinally lineolate with coarse, longitudinally elongate punctures, irregular in size, but mostly separated by a puncture width or more; supraclypeal area longitudinally lineolate, punctures rather small, limited to lateral area, longitudinally elongate. Paraocular areas below antennal bases, genal areas, and hypostomal areas also lineolate with small, widely separated, elongated punctures; frons, vertex, and thorax with more or less round punctures, as close as they can be in some areas, where somewhat separated, as on sides of thorax, ground between them dull; impunctate area lateral to each lateral ocellus; punctures of scutum moderately coarse, those of scutellum finer, of metanotum still finer; those of mesepisternum coarser than those of scutum, especially coarse ventrally; metepisternum horizontally striate above, finely punctate below like anterior part of side of propodeum; propodeal triangle rather dull, impunctate; metasoma with rather small punctures, coarsest on dorsum of first tergum, separated by lineolate ground which is duller on posterior terga; sterna shining, punctures widely separated on second and third, surface duller and punctures closer elsewhere. Head and thorax (including antennae) black, with the following bright yellow markings: triangular mark with base on lower end of clypeus and sharply pointed apex near middle of clypeus; spot on supraclypeal area between antennal bases; large paraocular spot extending from anterior mandibular articulation to point on inner orbit above level of antennal base and filling space between orbit and clypeal margin nearly to summit of clypeus; transverse band, broken medially, across summit of pronotum; posterior lobe of pronotum; large spot on side of scutellum extending onto mesial extremity of axilla; and propodeal triangle. Legs red except for black coxae, trochanters, and bases of femora; fore and mid tarsi infuscated; wings uniformly light yellowish brown; veins and stigma brownish black; metasoma dark green. Pubescence ochreous, that of frons, vertex, scutum, middle

of scutellum, second and following metasomal terga, and sixth sternum black, some fuscous hairs on forelegs and middle legs and upper parts of mesepisterna.

TYPE MATERIAL: Holotype female and one female paratype, 6 miles north of Nondugl, Western Highlands District, Northeastern New Guinea, 7000 feet altitude, May 27, 1959 (C. D. Michener), in the Bernice P. Bishop Museum.

The specific name refers to the conical projection on the propodeal triangle, a feature unknown among other bees.

Palaeorhiza (Palaeorhiza) infuscata, new species

Plate 11, figure 13

This is a close relative of *P. fulva* from New Guinea, agreeing with that species in most details of structure and color pattern, including the two low prominences on the third and fourth sterna of the male, and the darkened apical halves of the wings. It differs from *fulva*, however, in its larger size, more elongate head, the fulvous rather than black ground color of the head, and the infuscated thorax and metasoma which cause the species to resemble members of group *a* about as much as those of group *b*.

MALE: Length, 8 mm.; wing length, 6 mm. Relative head measurements: width, 11.6; length, 12.0; clypeal length, 5.7; lower interorbital distance, 5.0; upper interorbital distances, 6.0. Structure as in *fulva* but malar area as long as basal width of mandible; scutum and scutellum more shining, with punctures separated by about a puncture width (closer in *fulva*); mesepisternum with punctures finer, especially above, where they are separated by several puncture widths, ground between them smooth; posterolateral parts of propodeum much more finely punctate than in *fulva*; metasomal terga more finely and sparsely punctate than in *fulva*. Head fulvous, large area on lower half of clypeus and long paraocular marks extending from anterior mandibular articulation to point well above antennal bases cream colored; scape fulvous, without pale mark; flagellum brown, infuscated above; prothorax and legs fulvous, rest of thorax strongly infuscated, disc of scutum almost black; metasoma brownish black, posterior margins of segments broadly black.

TYPE MATERIAL: Holotype male and two male paratypes, Utupua, British Solomon Islands (one of the Santa Cruz Islands), June 3, 1933 (R. J. A. W. Lever). The holotype is in the British Museum (Natural History); the paratypes are in the Snow Entomological Museum of the University of Kansas and the collection of the Commonwealth Scientific and Industrial Research Organization.

The specific name refers to the brownish black or black thorax and metasoma.

Palaeorhiza (Palaeorhiza) stygica, new species

Text figures 470, 489-491, 494, 499

This is a large species, completely black in the female, in the male black except for limited yellow face marks. It is the only essentially completely black form known in the genus.

FEMALE: Length, 10 mm.; wing length, nearly 9 mm. Relative head measurements: width, 15.4; length, 13.7; clypeal length, 6.5; lower interocular distance, 8.3; upper interocular distance, 7.6. Eyes converging below except for upper thirds which converge strongly toward ocelli; malar area less than two-thirds as long as basal width of mandible; mandible tridentate, inner tooth a weak angle; genal area as wide as eye seen from side; interocellar distance more than half of ocellular distance, slightly more than ocellar diameter, much less than ocelloccipital distance; second submarginal cell more than two-thirds as long as first; inner hind tibial spur finely serrate. Lower half of face and hypostomal and genal areas minutely roughened with scattered small punctures; punctures progressively coarser and closer on frons and vertex where they are separated by less than a puncture width, still coarser on scutum, scutellum, and mesepisternum where they are separated by less than a puncture width of minutely roughened ground; metanotum weakly elevated medially, more finely punctate than scutellum; metepisterna still more finely and also more closely punctate; propodeum minutely roughened, punctures small and inconspicuous laterally, larger on posterior face, absent from triangle; metasomal terga with rather large, widely separated punctures, absent from posterior marginal zones; sterna similar but punctures coarser. Body and appendages black, metasoma with

very faint bluish green tint. Wings light yellowish brown basally, strongly dark brown distal to about basal vein, veins and stigma brownish black. Pubescence sparse, dull whitish, infuscated on apex of metasoma and to a lesser extent on face and dorsum of head and thorax.

MALE: Length, 10 mm.; wing length, 9 mm. Relative head measurements: width, 15.2; length, 14.3; clypeal length, 7.4; lower interocular distance, 7.0; upper interocular distance, 7.4. Agrees with description of female except as follows: malar area nearly as long as basal width of mandible; genal area narrower than eye seen from side; third metasomal sternum with very large basal projection on each side of middle; second, third, and to a lesser degree fourth, sterna with low, subapical, lateral, shining, rounded elevations. Punctures of scutum posteriorly coarser than in female; sides of propodeum more shining and with more conspicuous punctures than in female; metasomal sterna 1 to 3 with extensive impunctate shining areas. Clypeus with longitudinal, median, broken, yellow line; lower paraocular area with broken yellow streak, widest below; mandible with yellow streak extending from anterior articulation toward apex; anteroapical spots on front and middle femora, anterior side of front tibia, and anterobasal and anteroapical spots on middle tibia yellow.

TYPE MATERIAL: Holotype female, allotype male, and one female paratype, 6 miles north of Nondugl, Western Highlands District, Northeastern New Guinea, 7000 feet altitude, May 27, 1959 (C. D. Michener), in the Bernice P. Bishop Museum.

The specific name refers to the almost wholly black body, an unusual feature in the genus *Palaeorhiza*.

***Palaeorhiza (Anchirhiza) mandibularis*,**
new species

Plate 11, figure 12; text figures 471, 497

This is a rather large species, largely black, with a slightly metallic metasoma, yellow markings on the head and thorax, and largely red legs. The broad, edentate mandibles are unique; the mandibles of *P. (P.) conica* are similar in being edentate but are narrower.

FEMALE: Length, 9.5 mm.; wing length, 8.5 mm. Relative head measurements: width,

15.3; length, 12.6; clypeal length, 5.8; lower interocular distance, 8.5; upper interocular distance, 8.5. Eyes distinctly converging below except for upper thirds which converge strongly toward ocelli; malar area more than half as long as basal width of mandible; mandible little more than twice as long as broad, apex edentate; genal area slightly wider than eye seen from side; interocellar distance slightly less than half of ocellular distance, slightly longer than ocellar diameter, about half of ocelloccipital distance; scutellum, metanotum, and propodeal triangle all very flat in profile; second submarginal cell about two-thirds as long as first; inner hind tibial spur very finely serrate; second to fourth anterior tarsal segments with inner apical lobes exceeding outer ones. Clypeus, paraocular areas below antennal bases, and sides and upper part of supraclypeal area minutely roughened and with rather coarse, longitudinally elongated punctures, in many areas separated by less than a puncture width; center of lower part of supraclypeal area and malar area impunctate but minutely roughened; small, impunctate, dull area above base of antenna; nearly impunctate shining area lateral to lateral ocellus; otherwise, frons and vertex closely punctate; genal and hypostomal areas more sparsely punctate on dull ground; thorax more coarsely punctate than frons or vertex, punctures about as close as possible on most of scutum, slightly separated and a little coarser on posterior central part of scutum, on scutellum, sides of thorax, and propodeum; punctures separated by several puncture widths on metanotum, punctures very coarse on venter of mesepisternum; triangle of propodeum mostly almost horizontal, finely and irregularly roughened, not punctate; first four metasomal terga finely and closely punctured, first most coarsely so, others progressively more finely so; fifth and sixth terga with coarse, shallow punctures on dull ground; margins of terga narrowly impunctate; first four terga each with sublateral, preapical rounded elevation on each side; second and following sterna with very coarse punctures, broad impunctate apical margins on second to fourth, fifth with broad, closely and finely punctate brownish apical margin; second and third with lateral, preapical rounded elevations. Head and thorax black;

clypeus except anterior and lateral margins dark yellow; longitudinal mark on supraclypeal area extending above antennal bases dark yellow; paraocular area up to level of antennal base dark yellow, at that level yellow abruptly narrowed but continued up inner orbit to level well above antennal base; thorax with the following parts yellow: posterior margin of pronotum from one dorso-lateral angle to other, posterior lobe of pronotum, large lateral spot on scutellum including mesial part of axilla, metanotum except laterally; antenna black, under side of flagellum brown; tegula very dark brown, infuscated mesially; wings light brown, darker along costal margin of marginal cell; veins and stigma brownish black; coxae, trochanters, and basal parts of femora (to beyond middle of front femur) black, rest of legs red; metasoma black, with dark green (and purplish) tints above, dark blue tints below. Pubescence ochraceous, black on frons, vertex, scutum, and second and following metasomal terga, black intermixed on scutellum.

TYPE MATERIAL: Holotype female, Beaudesert, southern Queensland, April 29, 1954 (R. E. Harrison), in the Queensland Museum. This specimen was from the collection of the University of Queensland.

The specific name refers to the peculiar untoothed mandibles which are characteristic of the species and the subgenus

Meroglossa ocellata, new species

This species is most similar to *M. canaliculata* from which it differs in the red brown integument, the larger ocelli, and the finely toothed hind tibial spurs.

FEMALE: Length, 11 mm.; wing length, 9 mm. Relative measurements of head: width, 21.7; length, 18.3; clypeal length, 8.4; lower interocular distance, 10.4; upper interocular distance, 10.6. Eyes slightly converging below except near upper extremities where they converge toward ocelli; ocelli very large, ocellar diameter more than ocellocular distance; genal area slightly narrower than eye, blunt angle opposite lower end of eye; propodeal triangle small, only about one-third as wide as propodeum, declivous in profile (no horizontal and posterior surfaces separated by a rounded angle as in *canaliculata*); middle

and hind tibial spurs finely and closely ciliate, not coarsely toothed as in *canaliculata*; sixth tergum with small, impunctate, shining, hairless, apical area. Lateral parts of clypeus nearly impunctate but median part with coarse punctures separated by less than a puncture width, these punctures elongate above, similar punctation extending onto supraclypeal area; rest of head and thorax rather closely punctured, punctures fine and rather dense above antenna, separated by less than a puncture width on most of scutum but by several puncture widths in posterior part of disc, punctures of scutellum coarser and separated by less than a puncture width; punctures of metepisternum and propodeum as close as they can be, except for propodeal triangle which lacks punctures, but is dull; punctures of first metasomal tergum small, medially separated by several puncture widths; rest of metasoma coarsely punctured, especially on sterna, punctures of terga finer and denser laterally than middorsally. Integument red-brown, the following parts yellow: posterior lobe of pronotum, patch on upper part of mesepisternum in front of preepisternal groove; small spot on tegula; scutellum except lateral and marginal areas; small spot in center of metanotum. Wings, including veins and stigma, light yellowish brown. Pubescence short, sparse, ochraceous, dense and covering surface on sides of pronotum, metepisternum, and propodeum (except for bare triangle); longer hairs of third and following metasomal segments fuscous.

TYPE MATERIAL: Holotype female, Kings River, Northern Territory (McLennan), 1918, in the collection of the Commonwealth Scientific and Industrial Research Organization. The Kings River flows into the Arafura Sea about 180 miles east of Darwin.

The specific name refers to the large ocelli. No other species of the genus has this characteristic.

Nomia (Austronomia) maai, new species

Plate 13, figure 2; text figure 522

This is the most strongly metallic species of *Austronomia*. Although it is not so brightly colored as *N. (Mellitidia) gressitti* and *metallica*, it is nearly so, and is much brighter than members of the *flavoviridis* group of *Aus-*

tronomia. It is also peculiar in having the inner hind tibial spur pectinate with two or three large teeth but does not share other characters with *Melittidia*, the subgenus regularly characterized by a pectinate spur. Another interesting character of *maai* is the presence of scattered short hairs on the eyes.

FEMALE: Length, 7 mm. (to 8 mm.); wing length, 5.75 mm. (to 6 mm.). Relative head measurements: width, 14.8; length, 12.2; eye length, 9.3; lower interorbital distance, 8.0; upper interorbital distance, 9.0. Inner orbits converging below except for upper fourths which converge strongly toward ocelli; malar area very short; mandible broadest at base, approximately parallel sided from subapical tooth to basal broadening; labrum with basal part very short and transverse, process broad, with apex obtuse and keel present; inter-ocular distance much less than ocellular distance, the latter nearly four times an ocellar diameter; first flagellar segment much broader than long, second about as broad as long, remainder longer than broad. Pronotal lobe without carina; metanotum simple; propodeum with basal sloping zone narrower than metanotum, traversed by rugae which fade out into dorsolateral areas of propodeum, but not margined posteriorly by a carina or sharp line; inner hind tibial spur pectinate with two or three long teeth; third submarginal cell slightly longer than first. Clypeus and supraclypeal area shining, longitudinally striate, with well-separated elongate punctures among the striae; clypeus with broad, shallow, longitudinal, median depression continued onto lower part of supraclypeal area; rest of face rather closely punctate; median part of frons also longitudinally striate, only lateral part of paraocular area, along eye margin, broadly dull black and impunctate; genal areas more finely punctate than face; scutum and scutellum with surface minutely roughened and with rather coarse punctures separated by more than a puncture width (finer and closer marginally); sides of thorax largely minutely roughened, in most areas horizontally striate but lower part of mesepisternum vertically striate and most of propodeum punctate rather than striate; posterior face of propodeum dull, irregularly roughened, set off from lateral face by carina

reaching nearly to summit of posterior face; metasomal terga with broad, depressed, dull posterior margins, the first two distinctly punctate; rest of terga also minutely roughened and with punctures, mostly separated by more than a puncture width, becoming coarser and shallower on more posterior terga; sterna with punctures separated by less than a puncture width. Integument dark green, brassy on dorsum of thorax and on vertex, in some cases also on face, a large rounded blue (or blue-green) area on lower part of mesepisternum surrounded by narrow purple to brassy band; vertex separated from area around antennal base by purple to brassy band; broad black area along inner orbit; the following black or brownish black: antenna, labrum, mandible, tegula, legs, metasomal sterna; wings brownish, veins and stigma brownish black; tibial spurs dull red. Pubescence of head whitish, that of vertex and some hairs on frons fuscous; pubescence of thorax fuscous, that of scutum, scutellum, and some hairs on posterior lobe of pronotum fuscous; pubescence of coxae, trochanters, and femora whitish, of tibiae and tarsi fuscous on outer surfaces, yellowish red on inner surfaces, extreme apex of hind femur and tibial scopa with black hairs; metasomal terga with hairs black, whitish or yellowish on first, fuscous apically on fourth and fifth; sterna with whitish hairs; no apical tergal hair bands.

TYPE MATERIAL: Holotype female and one paratype, Minj, Western Highlands District, Northeast New Guinea, September 8-13, 1959 (T. C. Maa). One paratype (showing white hairs arising from tergal graduli) from Feramin, Northeast New Guinea, May 11-22, 1959 (W. W. Brandt). One paratype, Brown River, 27 miles from Port Moresby, Papua, April 22, 1959 (C. D. Michener). The holotype is in the Bernice P. Bishop Museum; the paratypes are in the Bernice P. Bishop Museum and the Snow Entomological Museum of the University of Kansas.

This species is named in honor of Mr. T. C. Maa in recognition of his studies of bees and other insects and his extensive collecting work in southeast Asia and elsewhere. The species has a broad altitudinal range, for the first locality is at about 5000 feet above sea

level, while the last is near the coast and scarcely above sea level.

***Nomia (Reepenina) bituberculata* (Smith)**

Plate 13, figures 8, 9; text figures
523, 524, 560-563

Megalocta bituberculata SMITH, 1853, p. 83.

Megaloctodes bituberculata: MOURE, 1958, p. 185.

Tetralonia testacea SMITH, 1854, p. 301. New synonymy.

Nomia (Reepenina) eboracina COCKERELL, 1912c, p. 377. New synonymy.

The species *bituberculata* was described from Brazil and the type, in the British Museum (Natural History), bears the label "Amazons, Brazil," obviously in error. Naturally it has not subsequently been captured in South America. The three specimens in the British Museum under the name *testacea* all bear the label "Africa" in the hand of F. Smith. Two of them are labeled "903"; in the old register this number is shown to indicate material from "N Holland" (=Australia). The other specimen, numbered 40, 4-2, 288, is indicated in the register as from Africa. This specimen is therefore the source of the erroneous label, "Africa," placed on all three specimens. After being described from South America and from Africa, the species was finally attributed to the correct continent by Cockerell (1912c) who described it under the name *eboracina*.

The specimen numbered 40, 4-2, 288 agrees best with Smith's description and is here designated, and has been labeled, as the lectotype of *Tetralonia testacea* Smith, 1854.

***Nomia (Ptilonomina) plumosa*, new species**

Plate 13, figures 6, 7; text figures 521, 554-559

This bee resembles, in appearance, a large, dark, nonmetallic, unbanded *Andrena* or *Leioproctus*. It differs from species of *Reepenina* not only by the subgeneric characters listed but by the long, coarsely plumose hair on the head and thorax. It differs from the forms of *Mellitidia* by striking characters indicated in the subgeneric descriptions and by the presence of long plumose hair not only on the sides but on the posterior surface of the propodeum.

FEMALE: Length, 13 mm.; wing length, 11 mm. Relative head measurements: width, 22.7; length, 19.0; eye length, 14.0; lower

interorbital distance, 14.2; upper interorbital distance, 11.3. Inner orbits subparallel except above, where they converge strongly toward ocelli; malar area about as long as basal width of mandible; mandible nearly as broad subapically as at base; labrum with broad convexity; labral process broad, apex blunt, keel strong, a sharp carina on each side of base of keel, these carinae diverging apically; interocellar distance slightly less than ocellular distance, the latter more than twice an ocellar diameter; first two flagellar segments about as broad as long, remaining segments conspicuously longer. Scutellum weakly biconvex; metanotum more strongly so, the convexities closer together; propodeum with basal zone not divided into pits; middle tibial spur finely serrate like hind tibial spurs; third submarginal cell distinctly longer than first, the latter about three times as long as second. Surfaces of head and thorax minutely roughened, hence not strongly shining; clypeus with strong punctures separated by more than a puncture width; lateral thirds of supraclypeal area and mesial two-thirds of paraocular area below antennal base similarly but slightly more closely punctate; rest of head and thorax with punctures minute and widely separated; metasomal terga more shining than head and thorax, with broad posterior, marginal, impunctate zones; first two terga with punctures minute and widely separated, remaining terga with punctures nearly as large as those of clypeus, separated by about a puncture width or by more mid-dorsally. Integument black, slightly brownish on apical part of mandible, labral process, and tegula; tibial spurs brown; wings yellowish brown, veins and stigma black. Pubescence of head and thorax rather long, strongly plumose, ochreous ventrally and laterally (including whole propodeum); hairs of face (except ochreous ones around antennal bases), vertex, scutum, scutellum, and metanotum (except posterior margin) dark fuscous or black, black hairs intermixed along posterior orbit and abundant on pronotal lobe and anterodorsal part of mesepisternum; hairs of propodeum not longer than those of rest of sides of thorax, thus not forming a distinct scopa as in *Mellitidia* although they do function for pollen carrying; hairs of coxae, trochanters, and femora ochreous, some black

ones at apices of femora; hairs of under sides of tibiae and tarsi bright ochreous, those of upper sides (including scopal hairs of outer side of hind tibia) black; hairs of first tergum, extreme sides of second to fourth terga, and of second to fourth sterna ochraceous, those of rest of second to sixth terga and fifth and sixth sterna fuscous or black, very short and sparse on second tergum.

MALE: Length, 11 mm.; wing length, 10 mm. Relative head measurements: width, 19.5; length, 17.0; eye length, 11.4; lower interorbital distance, 11.0; upper interorbital distance, 10.3. Differs from description of female as follows: Inner orbits converging below except for upper parts which converge strongly toward ocelli; malar area about twice as long as basal width of mandible; mandible small, shorter than clypeal length, tapering to pointed tip; labrum without convexity, process without keel or carina; first flagellar segment slightly longer than broad, others distinctly more than twice as long as wide, antenna reaching posterior end of thorax. Scutellum strongly biconvex. Fifth sternum unmodified except for small group of bristles on each side of midline; sixth also exposed, with large central group of erect, hooked, capitate bristles; seventh tergum much exposed, apex very broadly V-shaped. Punctures of lower part of face finer than in female and in many areas closer, clypeus with longitudinal impunctate zone; punctures of scutum posteriorly coarser, about like those of clypeus, where densest separated by less than a puncture width; metasomal terga and sterna with coarse piliferous punctures; impunctate marginal zone of first tergum narrow, those of other terga broad as in female. Small segments of tarsi brownish. Pubescence similar to that of female but more ochreous hairs around antennal bases, appressed ochreous hairs among erect black ones on lower lateral parts of face as high as level of antennal bases; black hairs on posterior margin of middle femur extending to middle of femur; upper surfaces of small segments of tarsi with hairs more orange than black.

TYPE MATERIAL: Holotype female and allotype male, 6 miles north of Nondugl, Western Highlands District, Northeast New Guinea, 7000 feet altitude, May 27, 1959 (C. D. Michener). One male paratype, Nondugl,

2200–2700 meters altitude, May 28, 1959 (C. D. Michener). One female and one male paratype, Daulo Pass (road between Goroka and Chimbu, Asaro-Chimbu Divide), Eastern Highlands District, Northeast New Guinea, 8200 feet altitude, May 2, 1959 (C. D. Michener). One female paratype, No. 6 Pengagl Camp, east slopes Mt. Wilhelm, Eastern Highlands District, Northeast New Guinea, July 1, 1959 (L. J. Brass, Sixth Archbold Expedition to Papua and New Guinea), in the American Museum of Natural History. One male and one female paratype, Chimbu-Kerowagi Divide, northeast New Guinea, July 6, 1955 (J. L. Gressitt). The holotype and allotype are in the Bernice P. Bishop Museum. The paratypes are in the Bernice P. Bishop Museum, the American Museum of Natural History, and the Snow Entomological Museum of the University of Kansas.

The specific name refers to the unusually long, loose, and coarsely plumose hairs of the body.

Nomia (*Mellitidia*) *gressitti*, new species

Plate 13, figures 4, 5; text figures 527, 528, 548–553

This fine, dark metallic blue-green species is similar only to *Nomia metallica* Smith from which it differs, to judge by the description, by the metallic green clypeus and the uniformly brownish wings, as well as by features of punctuation. My notes on the type of *metallica* (no direct comparisons made) indicate that the basitibial plate is broader than in other *Mellitidia*, while in *gressitti* it is slender as is usual in the subgenus.

FEMALE: Length, nearly 11 mm.; wing length, 9 mm. Relative head measurements: width, 19.0; length, 16.5; eye length, 12.0; lower interorbital distance, 11.0; upper interorbital distance, 9.3. Inner orbits converging below except for upper thirds which converge strongly toward ocelli; malar area about as long as basal width of mandible; mandible slightly broader subapically than at base because of broad flange on lower margin in apical half combined with the tridentate apex; labrum with broad convexity, process broad, pointed apically, with high keel and a small tooth on each side of base of keel; interocellar distance much less than ocellocular distance, the latter more than twice an ocellar diameter; first flagellar segment longer than broad,

second broader than long, remainder all longer than broad. Metanotum with strong median projection, rounded at tip but sides, if continued, would meet in acute angle; propodeum vertical in profile, triangular area more horizontal at sides where it is traversed by a few weak longitudinal ridges; tibial spurs as usual in the subgenus; third submarginal cell distinctly longer than first. Surfaces of head and thorax minutely roughened, hence not brilliantly shining; clypeus with broad, longitudinal, median depression, lower half of clypeus nearly impunctate, upper half and lateral margins with widely separated punctures of variable size; supraclypeal area largely impunctate medially, laterally with punctures separated by little more than a puncture width; rest of head and dorsum of thorax, and propodeum with small punctures separated by several puncture widths; episterna rugose, the roughenings forming vertical striae on lower part of mesepisternum and horizontal striae on upper part of metepisternum; metasomal terga with broad, depressed posterior margins which have moderate-sized punctures little more than one puncture width apart; rest of first tergum very finely and sparsely punctate; rest of second and third terga with coarse punctures widely separated; sterna with coarse punctures separated by a puncture width or less. Integument dark but bright green, bluish or purple along sutures, brassy around and in front of anterior ocellus; propodeum on posterior face below triangle with horizontal bands of green (above), purple, and brassy (below); mandible weakly greenish at base, otherwise black, reddish subapically; antenna black, flagellum very dark brown beneath; zone along inner orbit, extending mesad nearly to antennal base, black; tarsi black, basitarsi faintly greenish on outer surfaces; sixth tergum and sternum black; wings brownish, veins and stigma brownish black. Pubescence of head black, that of genal and hypostomal areas ochraceous (a few black hairs along posterior orbits), a few ochraceous hairs around antennal bases; pubescence of dorsum of thorax including posterior pronotal lobe and upper fifth of mesepisternum black except for short ochraceous hairs along scutoscutellar suture and on metanotum; sides and venter of thorax and whole pro-

podeum with ochraceous hairs; long dense scopa occupying entire lateral surface of propodeum (but not extending onto posterior surface) ochraceous; hairs of coxae, trochanters, and much of femora ochraceous, distal parts of femora as well as tibiae and tarsi with black hair; femoral scopa with basal two-thirds ochraceous, distal third black; venter and declivity of first tergum with ochraceous hair.

MALE: Length, 10 mm.; wing length, 8 mm. Relative head measurements: width, 17.6; length, 15.6; eye length, 11.0; lower interorbital distance, 8.6; upper interorbital distance, 9.2. Differs from description of female as follows: malar area nearly twice as long as mandibular width; mandible short, tapering to a point; labrum not convex basally, process very broad, apex broadly rounded, not keeled; summit of eye elevated well above adjacent part of vertex; first flagellar segment about twice as long as broad; following ones about three times as long as broad, becoming more slender apically, last one more than four times as long as broad; scutellum biconvex; metanotal projection with tip not much rounded, sides at right angles to one another; fourth sternum with posterior margin broadly emarginate, emargination filled with a row of black bristles; sixth tergum deeply emarginate between a pair of acute lateral projections. Clypeus more finely punctate than in female and with punctures in all areas; scutum much more coarsely punctate than in female, in contrast to vertex and scutellum; posterior face of propodeum with scattered coarse punctures laterally; first tergum as coarsely punctate as second. Integument green around ocelli as elsewhere; scutum in some cases more brassy; posterior face of propodeum with broad purple areas below triangle, otherwise brassy green; mandibles without greenish; black zone along inner orbit narrow, not approaching antennal base; sixth tergum green but seventh black. Pubescence as in female but with abundant ochraceous hairs around antennal bases, appressed ochraceous hairs among the erect black hairs on paraocular areas and sides of clypeus; ochraceous hairs replacing black on lateral parts of metanotum; black hairs present on upper half of mesepisternum; under sides of tarsi and of

tibiae, especially distally, with ochraceous hair; black pubescence of metasomal terga much longer than in female.

TYPE MATERIAL: Holotype female, allotype male, and four female and five male paratypes, Daulo Pass (road between Goroka and Chimbu, Asaro-Chimbu Divide), Eastern Highlands District, Northeast New Guinea, 8200 feet altitude, May 2, 1959 (C. D. Michener). Five female and nine male paratypes, 6 miles north of Nondugl, Western Highlands District, Northeast New Guinea, 7000 feet altitude, May 28, 1959 (C. D. Michener); the labels read "Nondugl, 2200-2700 meters." The holotype and allotype are in the Bernice P. Bishop Museum; the paratypes, in the same institution and the Snow Entomological Museum of the University of Kansas.

Additional females in the Bernice P. Bishop Museum, not designated as paratypes, bear the following data: Papua: Owen Stanley Range, Goilala, Loloipa, December 11-20, 1957, and February 1-15, 1958 (W. W. Brandt); Owen Stanley Range, Goilala, Tororo, 1560 meters altitude, February 15-20, 1958 (W. W. Brandt). Northeast New Guinea: Eliptamin Valley, 1665-2530 meters altitude, June 19, 1959 (W. W. Brandt); Feramin, 150-120 meters altitude, June 1-6, 1959 (W. W. Brandt).

This species is named for Dr. J. Linsley Gressitt of the Bernice P. Bishop Museum, Honolulu, who arranged for my trip to New Guinea and is indirectly responsible for the collection of every known specimen of the species.

***Nomia (Mellitidia) simplicinotum*, new species**

Plate 13, figure 3

This species differs from all other members of the subgenus except *longicornis* in the very weak, scarcely perceptible, median projection of the metanotum and in the sloping propodeal triangle, marked posteriorly by a carina and divided by longitudinal carinae. In both these respects it resembles *Austronomia* but differs from that subgenus in the inner hind tibial spur, the slender basitibial plate, and the long malar area. It differs from other metallic forms (*longicornis*, *metallica*, *gressitti*) by having the metallic coloration limited to the scutum and scutellum. Al-

though *longicornis* is known only in the male and *simplicinotum* only in the female, it seems most unlikely that they represent the same species, not only because of the localities from which they come but because *longicornis* has rufotestaceous tegulae and tarsi and the whole body brassy, characteristics not shared by *simplicinotum*.

FEMALE: Length, nearly 10 mm.; wing length, 7.5 mm. Relative head measurements: width, 17.0; length, 14.6; eye length, 11.3; lower interorbital distance, 9.5; upper interorbital distance, 8.6. Inner orbits distinctly converging below except for upper parts which converge strongly toward ocelli; malar area nearly two-thirds as long as basal width of mandible; mandible slightly broader subapically than at base as in *gressitti*; labrum similar to that of *gressitti* but convexity on base round rather than transverse, process more attenuate apically; interocellar distance less than ocellocular distance which is more than twice ocellar diameter; first flagellar segment slightly longer than broad, second almost twice as broad as long, remainder longer than broad. Metanotum with only a weak, posterior, median convexity representing the projection usual in the subgenus; propodeum with sloping, concave basal area about half as long as metanotum, margined posteriorly by a carina except medially, area with longitudinal carinae dividing it into about 16 spaces; tibial spurs as usual in the subgenus; third submarginal cell longer than first, the latter about three times as long as second. Surfaces of head and thorax minutely roughened and rather dull; clypeus with scattered, moderate-sized punctures, sparsest below and closest laterally; supraclypeal area with slightly smaller punctures, sparse medially; rest of head, dorsum of thorax, and posterior surface of propodeum with small, widely separated punctures, coarsest on scutellum, those of scutum with minute punctures scattered among the others; episterna rugose, the roughenings vertically strigose on lower part of mesepisternum and horizontally striate on upper part of metepisternum; metasomal terga with broad, depressed, posterior margins, those of first and second terga punctate basally, these marginal areas otherwise impunctate and minutely lineolate, producing a silky appearance; terga except for

marginal areas rather coarsely punctate, punctures of second tergum coarsest, larger than those of clypeus, irregularly placed so that there are broad impunctate spaces medially; sterna strongly punctured, closely so near posterior and lateral margins, many of punctures transversely elongated. Integument of head black, lower part of clypeus with ill-defined brown area, median part of mandible reddish brown; paraocular area, frons, and vertex with very faint greenish or purplish reflections. Thorax black, scutum and scutellum dark green, purplish along sutures; mesepisternum faintly greenish; tegula dark brown, irregularly infuscated, anterior part pale brown; legs dark brown, tarsi paler; wings faint yellowish brown, veins and stigma dark brown, the latter almost black; metasoma black, posterior margins of second, third, and fourth terga translucent gold (this color absent from second tergum in some paratypes, present on first tergum also in a specimen that is not a paratype). Pubescence of head ochraceous except for that of vertex which is fuscous; pubescence of thorax ochraceous except for that of scutum and scutellum which is fuscous (some paratypes have fuscous hairs intermixed on posterior lobe of pronotum and upper part of mesepisternum); propodeal scopa dense, long, limited to sides of propodeum, ochraceous; legs with hairs ochraceous, black or fuscous on outer sides of tibiae and tarsi, apex of hind femur with some black or fuscous hairs, including apex of the very full femoral scopa; metasomal pubescence fuscous dorsally (except for most of first tergum), ochraceous laterally and ventrally.

TYPE MATERIAL: Holotype, Nenguag, Asaro-Chimbu Divide, Eastern Highlands District, Northeast New Guinea, 2500 meters altitude, June 29, 1955 (J. L. Gressitt). Paratypes, one from each locality, Daulo Pass, Asaro-Chimbu Divide, Eastern Highlands District, Northeast New Guinea, 8200 feet altitude, May 2, 1959 (C. D. Michener). Bulolo, Northeast New Guinea, 1000 meters altitude, August 20, 1956 (E. J. Ford). Kamo Valley, Urapura, Wisselmeren, Netherlands New Guinea, 1530 meters altitude, August 15, 1956 (J. L. Gressitt). Tigi Lake, Wagheto, Wisselmeren, Netherlands New Guinea, 1700 meters altitude, August 17, 1956 (J. L. Gressitt).

The holotype is in the Bernice P. Bishop Museum. The paratypes are in that institution and in the Snow Entomological Museum of the University of Kansas.

A specimen not made a paratype is from Goroka, Eastern Highlands District, Northeast New Guinea, 5100 feet altitude, September 13, 1958 (J. H. Barrett).

The specific name refers to the simple metanotum; in most species of the subgenus it bears a strong spine.

***Lasioglossum (Australictus) fulvofasciae*,
new species**

Plate 14, figures 5, 6

This species differs from all other members of its subgenus by having in both sexes broad, apical, fulvous, integumental bands on the metasomal terga. *Lasioglossum peraustrale* and others also have fulvous bands, but they are on the bases of the terga and formed of hairs. The new species seems to be most closely related to *L. insculptum*, from which it differs not only in the integumental bands of the metasoma but in the red legs and tegulae and the more coarsely punctate scutum.

MALE: Length, 9 mm. (varying to 8 mm. among paratypes); wing length, 7.5 mm. (varying to 7 mm. among paratypes). Head rather short and broad, relative measurements as follows: head width, 13.5; length, 12.0; clypeal length, 3.75; lower interocular distance, 6.0; upper interocular distance, almost 8.0; clypeo-antennal distance, 3.0; interantennal distance, 2.0; antennocular distance, 2.0; antennocellar distance, 3.0; interocellar distance, 2.0; ocellocular distance, 2.0. Scape not reaching center of anterior ocellus; first flagellar segment as long as broad, rest long (second longest), crenulate, apex of flagellum nearly attaining posterior end of thorax. Body black, clypeus with lower part broadly yellow, yellow occupying about two-thirds of clypeus and produced upward medially to upper margin of clypeus; under sides of second and following antennal segments dark brown; tegula, posterior pronotal lobe, posterior third or more of each metasomal tergum and sternum, all of seventh tergum, and anterolateral areas on first tergum, fulvous; legs largely fulvous but with variable amounts of black on basal segments, more on

anterior than on posterior legs; type with coxae all black, upper side of hind trochanter black, fore and middle trochanters black, middle femur infuscated basally, front femur black on outer side except at apex. Pubescence of head, thorax, and legs ochraceous, white below, sparse except rather dense and obscuring surface on paraocular areas and near antennal bases, a small dense patch on anterolateral angle of pronotum, another around anterior thoracic spiracle; pubescence of terga short, sparse, whitish, with black hairs intermixed, narrow bands of white tomentum across bases of second and third metasomal terga; pubescence of metasomal sterna ochraceous, densest on apical parts of sterna, sixth sternum with a subapical patch of black hairs on each side of midline; fifth and especially sixth sternum depressed along longitudinal median line, sixth with median apical triangular, depressed, smooth, translucent area. Genitalia similar to those of *peraustrale* but gonobase larger and more flared basally; ventroapical process of gonocoxite broader basally, pointed apically, with hairs smaller, especially near outer margin; gonostylus shorter; apical process of seventh sternum longer than in *peraustrale*. Yellow part of clypeus shining and sparsely punctate, rest of clypeus with rather coarse, longitudinally elongate punctures, paraocular and genal areas dull and rather sparsely punctate, hypostomal area largely shining and impunctate, frontal area finely and densely punctate, vertex with short, irregular, widely spaced wrinkles; scutum and scutellum with fine punctures, rather dense around margins of sclerites, widely separated in center of scutellum, elsewhere separated by about two puncture widths, ground faintly shining, weakly bluish in some lights; episterna transversely striate above, mesepisternum irregularly roughened below, especially in front of pre-episternal groove, mesosternal area largely shining and nearly smooth; propodeum dull, dorsal surface nearly as long as scutellum, not margined, basal part weakly reticulately roughened. Metasoma finely and rather sparsely punctate; ventral part of seventh tergum, below the apical carina, coarsely punctate.

FEMALE: Length, 9 mm.; wing length, 7 mm. Relative measurements of head: width,

14.3; length, nearly 13.0; clypeal length, 4.0; lower interocular distance, 8.5; upper interocular distance, 8.5; clypeo-antennal distance, nearly 3.0; interantennal distance, 1.5; antennocular distance, 3.3; antennocellar distance, 3.5; interocellar distance, 2.0; ocellocular distance, 2.5. Scape reaching beyond ocelli; first as well as median flagellar segments, seen from beneath, about as broad as long. Coloration as in male but clypeus black, labrum and mandibles partly reddish; posterior lobes of pronotum black, fore femora infuscated, not black, on outer side. Pubescence as in male but not dense on face; scopa whitish; metasomal sterna with hairs all whitish. Structure of labrum, basitibial plate, and tibial spurs similar to those of *peraustrale*. Punctuation coarser than in male. Clypeus with coarse, widely separated punctures, some of them elongate, on shining ground; supraclypeal area with small, widely separated punctures on shining but finely roughened ground; frontal area dull, with punctures of two sizes, i.e., with well-separated punctures between which ground is coarsely roughened or minutely punctate; paraocular areas below and near eye margins shining with separate punctures, mesially similar but dull owing to roughening of ground; vertex and genal areas somewhat shining, with well-separated, raised alveoli from each of which a hair arises; scutum and scutellum with punctures close around margins but surface mostly shining, with faint bluish tint, punctures irregular in size, separated by several puncture widths; episterna horizontally striate above, mesepisterna vertically so below, ventrally dull, not striate; propodeum as in male but basal reticulate roughening scarcely detectable. Metasomal terga finely punctate, more closely so on anterior terga than on posterior ones, sterna more coarsely punctate.

TYPE MATERIAL: Holotype male, allotype female, and nine male paratypes, 3 miles west of Cunningham's Gap, southern Queensland, February 25, 1959, on flowers of *Bursaria spinosa* (C. D. Michener). The holotype and the allotype are in the Queensland Museum; the paratypes, in the collection of the Commonwealth Scientific and Industrial and Research Organization, the British Museum (Natural History), and the Snow Entomo-

logical Museum of the University of Kansas.

The specific name is a plural noun in apposition referring to the fulvous metasomal bands.

***Lasioglossum (Parasphecodes) permetallicum*,
new species**

This is the only species of *Parasphecodes* known from New Guinea. It is also the only metallic *Parasphecodes*; the dorsum of the thorax and to a lesser extent the metasoma are bright metallic green suggestive of the American halictine bees of the genus *Augochlora* and its allies. It is thus the most distinctive known species of *Parasphecodes*. Discovery of the male may show that this insect should be placed in a distinct subgenus.

FEMALE: Length, 9 mm. Relative measurements of head: head width, 13.5; length, 12.0; clypeal length, 3.3; lower interocular distance, 7.0; upper interocular distance, 7.5; clypeo-antennal distance, 2.5; interantennal distance, 1.5; antennocular distance, 2.5; antennocellar distance, 3.5; interocellar distance, 2.2; ocellocular distance, 1.6. Scape reaching to center of posterior ocellus; first flagellar segment about as long as broad, middle flagellar segments longer than broad. Dorsolateral angles of pronotum sharp, right-angled. Body black, clypeus, supraclypeal area, large ventrolateral area on mesepisternum, and metasoma (weakly on sterna) metallic bluish green, clypeus and supraclypeal area with purple and bronze reflections; scutum and scutellum brilliant metallic green. Legs, especially basally, and under side of flagellum, dark brownish black; tibial spurs blackish. Small areas of dense white pubescence on dorsolateral angle of pronotum, on anterior part of metanotum, and around anterior thoracic spiracle; otherwise pubescence of head and thorax sparse, whitish, a few fuscous hairs intermixed on dorsum; pubescence of coxae, trochanters, and femora (including femoral scopa) whitish, ventral brush on base of mid femur reddish fuscous; hairs of tibiae and tarsi reddish fuscous to black; first metasomal tergum and first three sterna and base of fourth with whitish hairs; rest of metasomal pubescence black. Clypeus shining with coarse, well-separated punctures of irregular size; supraclypeal area with

smaller punctures, medially separated by several puncture widths of shining but finely roughened ground, marginally punctures close; rest of face with punctures of same size as those on supraclypeal area but close, sparse only on lower lateral part of paraocular area; vertex and genal areas shining, with smaller and widely separated punctures; scutum with punctures almost as coarse as those of clypeus, separated by less than a puncture width of shining ground, closer and finer only at margins; scutellum with a slightly raised area on each side of midline almost as coarsely punctured as disc of scutum, otherwise finely and closely punctate; metanotum very finely and closely punctate; mesepisterna coarsely reticulate, more finely so above, a tendency toward horizontal striation above and posteriorly; metepisternum horizontally striate above, finely punctate below; propodeum with basal area slightly shorter than scutellum, with distinct margin not raised as a carina defining lunate area, the area shining, with widely separated, irregularly anastomosing striae which extend laterally beyond the area; sides or propodeum finely punctate, posterior surface shining and almost impunctate, margined laterally by carinae reaching up almost to dorsolateral angles of propodeum. Metasomal terga strongly punctate, ground between punctures shining on first two terga, progressively duller posteriorly, middorsally on first two terga punctures separated by one to two puncture widths; first three terga with dorsolateral rounded elevations in front of depressed apical margins, these elevations more shining and less closely punctured than adjacent areas.

TYPE MATERIAL: Holotype female, Mafulu, Papua, 4000 feet altitude, January, 1934 (L. E. Cheesman), in the British Museum (Natural History).

Since the above description was written and the type returned to London, two additional females have been received through the courtesy of Dr. M. A. Lieftinck. They are from the Star Range, Netherlands New Guinea, 1260 meters altitude, June 15 and August 10, 1959 (Sibil), in the Rijksmuseum van Natuurlijke Historie. The metallic coloration of the face, the sides of the thorax, and the metasoma is weak, especially in one specimen.

The specific name refers to the metallic coloration, which is unique in the subgenus.

Lasioglossum (Pseudochilactis) imitator,
new species

Plate 14, figure 7; text figures 573, 574, 620

Superficially very similar to *L. lanarium* and its allies but differing strikingly in the subgeneric characters.

FEMALE: Length, 8 mm. (varying to nearly 9 mm. among paratypes); wing length, 7 mm. Relative head measurements: width, 14.4; length, 12.8; clypeal length, 3.3; lower interocular distance, 8.3; upper interocular distance, 8.8; clypeo-antennal distance, 3.0; interantennal distance, 1.4; antennocular distance, 2.8; antennocellar distance, 3.5; interocellar distance, 2.6; ocellocular distance, 2.5. Lower half of clypeus below lower ends of eyes; scape reaching upper edge of posterior ocellus; flagellar segments longer than broad except for second and third which are slightly broader than long. Body and appendages black; mandible red medially; second and following flagellar segments dark brown beneath; tegula translucent brown, blackish near scutum; legs somewhat brownish, especially small segments of tarsi; wings brownish, veins and stigma dark brown; apical margins of metasomal segments brown but not translucent. Pubescence pale ochraceous, whitish on sides and venter, yellow on under sides of tarsi, rather long but not obscuring surface except for white tomentum behind dorsolateral angles of pronotum, around anterior thoracic spiracles, on anterior median part of metanotum, large basolateral patches on second tergum, and bands (concave posteriorly) on second and third terga, these bands less than one-third as long as tergum medially and less than one-half laterally. Clypeus with lower two-thirds shining, with irregular very large punctures separated by about a puncture width, upper third with smaller, closer punctures; supraclypeal area with punctures similar to those of upper part of clypeus, well separated medially, close laterally; rest of face similarly punctate except for broad impunctate area along lower orbit, punctures finer and close on frons, fine and separated by shining ground on vertex, still finer on genal area which is wider than eye seen from side; hypostomal area faintly lineolate.

Scutum with punctures slightly finer than those of supraclypeal area and close around margins, elsewhere coarser than those of supraclypeal area and on disc separated by about a puncture width of shining ground, anteromedian area with area having punctures smaller and separated by several puncture widths of shining ground. Scutellum mostly punctured like margins of scutum, but on each side of midline is a convexity with punctures separated by about a puncture width of shining ground. Mesepisterna coarsely rugose anteriorly, fading into inconspicuous irregular striae posteriorly, conspicuous transverse striae posteroventrally; metepisterna horizontally striate above, finely roughened below; propodeum minutely roughened laterally with scattered punctures, posterior surface smooth and impunctate except for finely punctate upper edge, no carinae margining posterior surface laterally, area about as long as metanotum, irregularly finely rugose-striate, striae not reaching posterior margin medially where surface is dull and minutely roughened, median third of area delimited posteriorly by a feeble angle which is depressed onto posterior face medially. First two metasomal terga strongly punctured to margins, largest punctures (on first tergum) almost as large as supraclypeal punctures and separated by about half of a puncture width, on second tergum punctures smaller and more widely separated; remaining terga with punctures finer and ground between them minutely roughened. Labrum tumescent medially, process as shown in figure 573; median keel high and rounded apically.

TYPE MATERIAL: Holotype female, in the collection of the Commonwealth Scientific and Industrial Research Organization, and one female paratype, 11 miles south of Uralla, New South Wales, November 5, 1958 (C. D. Michener); 23 female paratypes, Guyra, New South Wales, November 6, 1958 (C. D. Michener); four female paratypes, Glen Innes, New South Wales, November, 1958 (C. D. Michener); seven female paratypes, Bunya Mountains, southern Queensland, 3000 feet altitude, October 24, 1958 (C. D. Michener). The paratypes are in the Snow Entomological Museum of the University of Kansas, the collection of the Commonwealth Scientific and Industrial Research Organiza-

tion, the Queensland Museum, and the British Museum (Natural History).

Specimens were collecting pollen on *Helipterum anthemoides*, *Helichrysum bracteatum*, *Hypochoeris radicata*, and *Leptorhynchus squamatus*. Two specimens were visiting flowers of *Daviesia latifolia* but not collecting pollen.

The specific name refers to the similarity of this species to some forms of *Chilalictus*.

***Lasioglossum (Chilalictus) cephalochilum*,
new species**

Plate 14, figure 2; text figure 594

This small species is similar to *L. gynochilum* but differs in its slightly smaller size, more shining scutum, and especially in the labrum. It is described here in order to illustrate a form with a labral process intermediate between the simple structure of *helichrysi* and the strongly pectinate, tricarinate structure of *gynochilum*. *Lasioglossum cephalochilum* is not a *Wahlenbergia* bee, as are the other *Chilalictus* described here.

FEMALE: Length, 5 mm. (slightly less in holotype); wing length, 3.3 (in holotype) to 3.5 mm. Head short and broad, eyes distinctly converging below; relative measurements of head: width, 7.7; length, 6.8; clypeal length, 1.6; lower interocular distance, 4.2; upper interocular distance, 5.0; clypeo-antennal distance, 1.2; interantennal distance, 1.0; antennocular distance, 1.3; antennocellar distance, 2.6; interocellar distance, 1.4; ocellocular distance, 1.5. Agrees with description of *L. wahlenbergiae* except as indicated below: tegula more translucent yellowish brown laterally; legs somewhat brownish, bases and apices of tibiae paler; posterior margins of metasomal segments brownish; tibiae with pubescence entirely whitish; band of third tergum less than half as wide as tergum laterally, that of fourth tergum very broad; hair (not tomentum) of third to fifth terga rather abundant and yellowish in some lights. Supraclypeal area with punctures coarser than in *wahlenbergiae*, like finer punctures of upper edge of clypeus, separated by less than a puncture width, ground between slightly roughened but shining; vertex transversely strigose behind ocelli; hypostomal area only weakly lineolate, smooth laterally; scutum shining, punctures of disc much coarser than those of vertex, slightly coarser than those

of supraclypeal area, separated by less than a puncture width of shining ground, punctures finer and closer around lateral and posterior margins but anterior margin transversely rugose, strigose area extending back along midline nearly to middle of scutum, in this region striae converging posteriorly toward midline; scutellum with discal part like disc of scutum, margins with punctures finer and close; carinae of propodeal area irregularly anastomosing medially where they do not reach posterior margin of area, a region that is minutely transversely roughened. Labrum tumescent only medially, process as shown in figure 594, median keel high, upper margin of apex of keel expanded to arrowhead-shaped structure seen from above; sublateral carina short but high. Inner hind tibial spur shaped like that of *obscurissimum*.

TYPE MATERIAL: Holotype female and 15 female paratypes, Glen Innes, New South Wales, November 6, 1958 (C. D. Michener), on *Leptorhynchus squamatus*. The holotype is in the collection of the Commonwealth Scientific and Industrial Research Organization. The paratypes are in the Snow Entomological Museum of the University of Kansas, the British Museum (Natural History), the collection of the Commonwealth Scientific and Industrial Research Organization, and the Queensland Museum.

The specific name refers to the expanded, headlike apex of the keel of the labrum.

***Lasioglossum (Chilalictus) gynochilum*,
new species**

Plate 13, figure 12; plate 14, figure 1;
text figures 595, 596

Superficially specimens of this species resemble small individuals of *L. wahlenbergiae*. The short antennae and black clypeus of the male, the basally narrowed labral process of the female, and the less closely punctured mesonotum distinguish *gynochilum* readily from *wahlenbergiae*.

FEMALE: Length, 5 mm.; wing length, 4 mm. Head short and broad, eyes strongly converging below; relative measurements: head width, 9.4; length, 7.8; clypeal length, 2.0; lower interocular distance, 5.1; upper interocular distance, 6.6; clypeo-antennal distance, 1.3; interantennal distance, 1.1; antennocular distance, 1.7; interocellar distance,

1.7; ocellocular distance, 1.9. Lower third or fourth of clypeus below lower ends of eyes; scape reaching center of anterior ocellus; first flagellar segment scarcely broader than long, middle ones about 1.5 times as wide as long, flagellum therefore very short. Body and appendages black; mandibles red medially; fourth and following flagellar segments light brown beneath; tegula translucent yellowish brown, infuscated along inner margins; wings clear, veins and stigma brown; mediotarsi and distitarsi reddish brown; apical margins of terga and sterna brownish. Pubescence as in *wahlenbergiae* but without dark hairs on tibiae; tomentous band on third tergum not narrowed medially. Punctuation of head as in *wahlenbergiae* but with somewhat more contrast between the finely, closely punctate and dull frons and the more shining vertex; scutum with punctures much coarser than those of vertex, in most areas separated by slightly less than a puncture width, ground minutely roughened in most areas, punctures closer and ground duller marginally and along longitudinal median line; scutellum similar to scutum but punctures finer; sides of thorax similar to *wahlenbergiae* but sculpturing finer, transverse striae on lower parts of mesepisterna absent; propodeum as in *wahlenbergiae* but striae of area not reaching posterior margin except laterally, marginal part of area dull and minutely roughened; first two metasomal terga with punctures finer than those of frons, separated on the average by about a puncture width, finer on posterior part of second tergum and on remaining terga. Labrum broadly tumescent, process narrowed basally (fig. 595), median keel high, rounded apically, sublateral carina with two high teeth.

MALE: Length, 4.5 mm.; wing length, 3.5 mm.; relative measurements: head width, 8.0; head length, 6.8; clypeal length, 1.7; lower interocular distance, 4.0; upper interocular distance, 5.7; clypeo-antennal distance, 1.3; interantennal distance, 1.0; antennocular distance, 1.3; antennocellar distance, 2.2; interocellar distance, 1.6; ocellocular distance, 1.8. Approximately lower fourth of clypeus extending below lower ends of eyes; scape almost reaching lower margin of anterior ocellus; first flagellar segment broader than long, second shortest, third as long as first, succeeding ones progressively longer so that sub-

apical ones are nearly as long as broad, only apical one longer than broad; antenna reaching tegula. Clypeus black; mandibles reddish or yellowish medially; flagellum except first segment dark brown beneath; coloration otherwise as in female. Pubescence as in *wahlenbergiae* but that of face not much denser than in female; metasomal sterna without densely pubescent area; tomentum of terga limited to small basolateral areas on second and third terga. Sculpturing of head as in female but surfaces more shining, frons less closely punctured; sculpturing of thorax as in female but ground between punctures on scutum and scutellum smooth, pleural sculpturing somewhat finer than in female.

TYPE MATERIAL: Holotype female, allotype male, in the collection of the Commonwealth Scientific and Industrial Research Organization, and 12 female and 11 male paratypes, Helidon (east of Toowoomba), southern Queensland, October 20, 1958, and January 8, 1959 (Michener, Michener and Sekhon), on flowers of *Wahlenbergia*. The holotype was taken on October 20. The paratypes are in the collection of the Commonwealth Scientific and Industrial Research Organization, the Queensland Museum, and the Snow Entomological Museum of the University of Kansas.

The specific name refers to the striking and distinctive labral process of the female.

Lasioglossum (Chilalictus) obscurissimum,
new species

Plate 14, figures 3, 4; text figures 597, 598

This small species is easily recognized by finely roughened and dull integument and by the very short, broad face. Superficially it resembles *cephalochilum* but differs not only in those features but in the labral process.

FEMALE: Length, 5.5 mm.; wing length, 3.5 mm. Head extraordinarily short and broad, eyes converging below; relative measurements: head width, 8.7; length, 7.0; clypeal length, 2.0; lower interocular distance, 5.0; upper interocular distance, 6.0; clypeo-antennal distance, 1.0; interantennal distance, 1.4; antennocular distance, 1.5; antennocellar distance, 2.3; interocellar distance, 1.7; ocellocular distance, 1.8. Clypeus extending but little below lower ends of eyes; scape reaching middle of anterior ocellus; first fla-

gellar segment about as broad as long, third shortest, nearly twice as broad as long, middle segments much broader than long so that flagellum is very short. Body and appendages black; mandibles red medially; fourth and following flagellar segments pale brown beneath, dark brown above; tegula translucent light brown, infuscated near scutum; wings clear, slightly milky, veins and stigma rather light brown; margins of terga translucent whitish brownish preapically, mediotarsi and distarsi brownish. Pubescence dull white, yellowish on under sides of tarsi and apex of middle tibia, pubescence sparse and not covering surface except on dorsum of posterolateral angle of pronotum and area around anterior thoracic spiracle; tomentum of metasomal terga sparse, forming basolateral patches on second and broad basal bands on third and fourth, these areas not clearly defined, and in combination with abundant hairs giving apical part of metasoma a pruinose appearance. Clypeus minutely roughened and dull, apical two-thirds with distinct, rather large punctures separated by more than a puncture width except along anterior margin; supraclypeal area dull, with scattered, widely separated, scarcely recognizable punctures; frons dull, with minute dense punctures so arranged as to form fine longitudinal striae; paraocular and genal areas and vertex with punctures of similar size separated by ground which is somewhat shining, especially along eye margins; hypostomal areas weakly striate; scutum and scutellum dull, with fine, often inconspicuous punctures separated by two puncture widths in most areas; episterna horizontally striate above, weakly roughened and somewhat shining below; propodeum distinctly but finely roughened and with scattered small punctures laterally and posteriorly, area longer than metanotum, shorter than scutellum, striae not reaching posterior margin, leaving broad, finely roughened zone between striate zone and margin of area, margin not sharply defined, lateral carinae margining posterior surface of propodeum reaching up less than halfway to dorsolateral angles of propodeum. First metasomal tergum with fine punctures separated by more than a puncture width of shining ground; remaining terga duller, punctures finer, piliferous, and ground somewhat

roughened. Labrum with broad irregular tumescence; process as shown in figure 597, median keel high and rounded apically, sublateral carina represented only by small, high tooth.

MALE: Length, 4 mm.; wing length, 3 mm. Relative measurements of head: width, 7.3; length, 6.0; clypeal length, 1.6; lower interocular distance, 3.7; upper interocular distance, 4.8; clypeo-antennal distance, 1.0; interantennal distance, 1.3; antennocular distance, 1.0; antennocellar distance, 2.0; interocellar distance, 1.5; ocellocular distance, 1.4. Clypeus scarcely extending below lower ends of eyes; scape reaching anterior edge of anterior ocellus; first flagellar segment broader than long, second and third more than 1.5 times as broad as long, remaining segments progressively longer, tenth still broader than long, only eleventh longer than broad. Coloration as in female but flagellum dark brown beneath, blackish brown above; inconspicuous brownish areas at bases and apices of tibiae, legs in some specimens rather extensively dark brownish; tergal margins more noticeably transparent whitish. Pubescence as in female but tomentum of metasomal terga limited to sparse basolateral patch on second; sterna 3 to 5 and apex of second sternum with broad area of suberect white hairs, not dense like hairy patch of *wahlenbergiae*. Sculpturing similar to that of female but finely roughened surfaces less dull, frons scarcely strigose, mesepisternum scarcely striate.

TYPE MATERIAL: Holotype female, allotype male, 28 female paratypes, and 15 male paratypes, Helidon (east of Toowoomba), southern Queensland, October 20, 1958, and January 8, 1959, all on *Wahlenbergia* (C. D. Michener). The holotype, taken October 20, is in the collection of the Commonwealth Scientific and Industrial Research Organization. The paratypes are in that institution, the Snow Entomological Museum of the University of Kansas, the British Museum (Natural History), and the Queensland Museum.

An additional pair of specimens comes from 13 miles north of Stanthorpe, Queensland, December 29, 1958, on *Wahlenbergia* (C. D. Michener).

The specific name refers to the small size, inconspicuous coloration, and dull integument.

Lasioglossum (Chilalictus) wahlenbergiae,
new species

Plate 13, figures 10, 11; text figures
592, 593, 621, 622

This is the largest of the four species described herein that favor flowers of *Wahlenbergiae*. It differs from some superficially similar forms such as *pulvitectus* and *helichrysi* by the slightly smaller size, finer punctation, and apically convergent and strongly pectinate margins of the labral process.

FEMALE: Length, 6 mm.; wing length, 4.5 mm. Head short and broad, eyes distinctly converging below; relative measurements: head width, 10.8; length, 9.0; clypeal length, 2.5; lower interocular distance, 5.8; upper interocular distance, 7.0; clypeo-antennal distance, 1.7; interantennal distance, 1.4; antennocular distance, 2.0; antennocellar distance, 2.7; interocellar distance, 2.0; ocellocular distance, 1.9. Lower third or fourth of clypeus below lower ends of eyes; scape reaching upper margin of anterior ocellus; first flagellar segment about as long as broad, middle ones slightly broader than long. Body and appendages black; mandible red medially; third and following segments of flagellum brown beneath; tegula reddish brown, black along inner sides; wings clear, veins and stigma brown; mediotarsi and distitarsi reddish brown. Pubescence whitish, faintly yellowish on dorsum of thorax, reddish yellow on under sides of tarsi, brown patch on outer side of middle tibia, hind tibia with scopal hairs of basal and posterior region infuscated. Pubescence sparse and not covering surface except for the following areas of dense tomentum: dorsum of pronotum (narrow posterior band between dorsolateral angles); vicinity of anterior thoracic spiracle, anterior part of metanotum, large basolateral area on second metasomal tergum, basal band on third tergum less than half as wide as tergum medially and half as wide laterally, basal band on fourth tergum more than half as wide as tergum. Clypeus with coarse punctures separated by less than a puncture width, ground between them shining medially, dull above; supraclypeal area with small, widely separated punctures, ground dull; rest of face, vertex, scutum, and scutellum finely and densely punctate, slightly more coarsely so on thorax than on head, punctures sepa-

rated, if at all, by much less than a puncture width except on the rather shiny vertex; hypostomal area longitudinally striate, striae curving up posterior parts of genal area nearly to summit, zone near eye punctate like vertex; mesepisternum coarsely rugose anteriorly, horizontally striate medially and posteriorly, striae becoming transverse below; metepisterna horizontally striate above, finely punctate below; propodeal area longer than metanotum but shorter than scutellum, finely radially striate, short transverse connectives at intervals between striae producing an irregular aspect; striae not extending beyond area; area not sharply margined; posterior and lateral surfaces of propodeum minutely roughened, carinae margining former not reaching dorsolateral angles which are rounded; first two metasomal terga with punctures about as large as those of frons, separated by less than a puncture width, finer on broad, apical, slightly depressed part of second; remaining terga more finely punctate. Labrum broadly tumescent nearly to sides, process as shown in figure 592, median keel high and rounded apically seen in profile; sublateral carina with high subapical tooth and smaller premedian tooth.

MALE: Length, 5 mm.; wing length, 4 mm. Relative measurements of head: width, 10.2; length, 9.0; clypeal length, 2.5; lower interocular distance, 5.0; upper interocular distance, 6.7; clypeo-antennal distance, 1.9; interantennal distance, 1.5; antennocular distance, 1.7; antennocellar distance, 2.2; interocellar distance, 1.8; ocellocular distance, 1.8. Approximately lower third of clypeus below lower ends of eyes; scape almost reaching anterior edge of anterior ocellus; first flagellar segment broader than long, second about one and one-half times as long as broad, segments 3 to 10 progressively shorter but all longer than broad, segment 11 about as long as segment 2. Lower two-thirds of clypeus with broad, transverse, pale yellow mark, weakly pointed above medially; mandibles yellowish medially; flagellum dark brown, first segment and upper surface nearly black; tegula paler than in female, outer margins translucent; knees, apices of tibiae, and tarsi testaceous. Pubescence white, yellowish on under sides of tarsi, rather dense on paraocular areas and around antennae, tomentum distributed as

in female but on terga limited to basolateral areas of terga 2 to 4; metasomal sterna with ill-defined, large, triangular area of dense, plumose, white hairs beginning on central apical part of second sternum and becoming broader posteriorly until it occupies full width of fifth sternum. Sculpture of head similar to that of female but ground more shiny, especially on supraclypeal area; scutum and scutellum much more coarsely punctate than in female, and much more coarsely so than head, punctures separated by about a puncture width except anteriorly and narrowly along outer margins of scutum where they are finer and closer; sides of thorax and propodeum as in female but zone just behind margin of area shining; metasomal punctation about as in female but posterior depressed zones of second and following terga almost impunctate although dull.

TYPE MATERIAL: Holotype female and two female paratypes, 8 miles west of Armidale, New South Wales, November 3, 1958. Allotype male and eight female and three male paratypes, Helidon, southern Queensland (east of Toowoomba), October 20, 1958. Additional paratypes, New South Wales, one female, 11 miles south of Uralla, October 5, 1958; seven females, Glen Innes, November 6, 1958. Queensland, four males, 13 miles north of Stanthorpe, December 29, 1958. All this material was taken on flowers of *Wahlenbergia* by C. D. Michener. The holotype and allotype are in the collection of the Commonwealth Scientific and Industrial Research Organization; the paratypes are in that institution, the Snow Entomological Museum of the University of Kansas, the Queensland Museum, and the British Museum (Natural History).

This species is probably an oligolectic visitor of flowers of *Wahlenbergia*, the Australian bluebell, after which this bee is named.

Homalictus ctenander, new species

Plate 14, figures 10, 12; text figures
606-608, 628, 629

This extraordinary species is remarkable for its broad face, the fact that the eyes in both sexes are farther apart at the lower than at the upper ends, for the short, broad clypeus and strongly bituberculate labral base, for the erect lamella behind the dorsolateral

angle of the pronotum, and for the pectinate inner hind tibial spur of the male. The frontal carina is present from the upper end of the supraclypeal area to a point a short distance above the level of the antennal bases. All of these characters are suggestive of the Samoan *Ecthralictus extraordinarius*, which has a very similarly shaped face and clypeus. The simple mandibles and lack of scopa in *Ecthralictus* are indicative of a parasitic habit presumably not shared by *H. ctenander*, although the scopa of the legs and metasomal venter in the latter is rather sparse. In *extraordinarius*, also, the pronotal modification is a projection rather than a lamella. Nonetheless, the possibility of a relationship between *H. ctenander* and *Ecthralictus* exists, although the similarities are more likely to be parallelisms. *Homalictus perpessicius* from Samoa, a rather ordinary *Homalictus*, has a bituberculate labrum and pectinate hind tibial spur in the male, suggesting that *Ecthralictus* arose from it or a close relative on the islands where it now occurs.

FEMALE: Length, 7.5 mm.; wing length, nearly 6 mm. Head large; genal area as wide as eye seen from side; small median tubercle at rear edge of vertex; eyes converging toward ocelli, lower parts of inner orbits slightly converging below; clypeus about three times as broad as long; relative measurements of head: width, 12.5; length, 10.5; clypeal length, 2.1; lower interorbital distance, 7.6; upper interorbital distance, 6.7; clypeo-antennal distance, 1.9; interantennal distance, 1.1; antennocular distance, 2.6; antennocellar distance, 3.6; interocellar distance, 1.4; ocellocular distance, 1.8. Almost none of clypeus below lower ends of eyes; scape reaching above level of ocelli (length, 6.0); first and second flagellar segments broader than long, first smaller than second, remaining flagellar segments longer than broad and progressively longer toward apex. Head black; thorax black (brownish laterally and posteriorly in paratype), scutum bright metallic purple (green in certain lights); metasoma brownish black (largely dark brown in paratype); antenna, legs (except fore coxae and bases of other coxae), posterior lobes of pronotum and tegula orange, the latter transparent; mandible dark orange, infuscated basally, black (or red-brown) apically; wings clear, veins

and stigma dark brown. Pubescence sparse, dull white, white tomentum on dorsum of pronotum; prepygidial fimbria fuscous. Lower three-fifths of clypeus convex, shining, with irregular coarse punctures; rest of head with surface dull (except for shining lower part of supraclypeal area), punctures small and widely separated, absent from depressed lower lateral parts of paraocular areas; frons finely vertically striate; pronotum with carina from posterior lateral angle to posterior lobe strongly elevated behind angle and directed posteriorly, so that seen from side this portion of carina forms a high rounded crest; below this crest several strong, widely separated striae extend ventroposteriorly almost to level of base of coxa; scutum shining throughout although faintly roughened anteriorly and laterally, punctures very fine and widely separated anteriorly and laterally, on disc scattered coarser punctures intermixed among smaller ones but distance between punctures several puncture widths; scutellum similarly but more closely punctate, especially closely so around margins; sides of thorax dull, upper parts of episterna finely horizontally striate, lower part of mesepisternum finely vertically striate; area of propodeum shining, especially posteriorly, with fine, well-separated, radiating carinae that are somewhat irregular and do not reach margin of area medially; margin of area not evident; posterior surface of propodeum shining but minutely roughened, with scattered minute punctures, margined laterally by carina which extends well above middle of side of lateral surface; inner hind tibial spur with two long teeth (fig. 607); metasoma almost impunctate dorsally, first tergum smooth, following ones minutely lineolate. Labrum with two strong tubercles, process slender, keel flat above so that it does not appear as keel but spreads out, hiding bases of marginal bristles.

MALE: Length, 7 mm.; wing length, 5 mm. Head extraordinarily broad, shaped much like that of female, genal area wider than eye seen from side and angulate at level of lower end of eye, tubercle at rear edge of vertex larger than in female, relative measurements of head: width, 12.4; length, 9.5; clypeal length, 2.0; lower interorbital distance, 8.7; upper interorbital distance, 7.3; clypeo-antennal distance, 1.3; interantennal distance,

1.7; antennocular distance, 2.7; antennocellar distance, 2.7; interocellar distance, 1.4; ocellular distance, 2.3. Agrees with description of female except as follows: second flagellar segment longer than broad, third and fourth long, succeeding ones progressively shorter except last which is long; mandible very large (length, 8.5), pointed, middle third parallel sided (not tapering) owing to flange on anterior margin of mandible; hypostomal carina elevated in front of middle (carina itself not high but ground around it), anterior half of carina not along margin of proboscoidal fossa. Scutum with only weak purple tints; mandible almost wholly yellowish; distal part of flagellum brown above. Median third of clypeus strongly protuberant, shining, with widely separated irregular punctures; lower lateral parts of paraocular areas neither depressed nor impunctate; scutellum not closely punctate around margins; lower part of mesepisternum only finely lineolate; propodeal area with striae few, weak, and short, not reaching middle; labrum flat basally, not bituberculate.

TYPE MATERIAL: Holotype female, allotype male, and one male and one female paratype, Kerang, Victoria, March 29, 1948 (holotype and allotype), and January 8 and 18, 1947 ("R. T."), in the Burns collection, to be deposited in the National Museum of Victoria.

The specific name refers to the extraordinary feature of a pectinate inner hind tibial spur in the male. Such spurs ordinarily occur only in females.

Homalictus tricolor, new species

This species is remarkable for its large size, dull, minutely roughened integument, with in general sparse and widely separated punctures, dark brown wings, largely dark red metasoma, and black scopa. The dull integument is suggestive of the group of *H. blackburni* and *dampieri*, and it further agrees with those species in the lack of a frontal carina, but differs from them in the other characters listed above.

FEMALE: Length, 8 mm.; wing length, nearly 7 mm. Wings extending well beyond apex of metasoma. Relative measurements of head: width, 12.0; length, 10.0; clypeal length, 2.9; lower interocular distance, 7.0;

upper interocular distance, 7.2; clypeo-antennal distance, 2.1; interantennal distance, 0.9; antennocular distance, 2.6; antennocellar distance, 3.6; interocellar distance, 1.4; ocellular distance, 2.2. About lower two-fifths of clypeus below lower ends of eyes; scape reaching well above level of ocelli (length, 6.5); first flagellar segment about as long as broad, second broader than long, others all longer than broad and becoming progressively longer toward apex. Head and thorax dull dark blue-green, appendages black except for reddish small segments of tarsi and distal part of mandible; clypeus, supraclypeal area, and lower lateral part of paraocular area black or largely so (sides of head and of thorax brownish black and nonmetallic in one paratype); tegula dark brown to blackish, translucent laterally, in one paratype with light brown discal area; wings dusky, veins and stigma blackish; metasoma dark red, basal two-thirds of first tergum black (in one paratype metasoma mostly blue-black, red limited to apical part of first tergum, most of second tergum, and diffuse basolateral areas on third; in another paratype metasoma wholly red except for dusky areas on first tergum). Pubescence of head black, fuscous on genal area and vertex; pubescence of thorax white, with black hairs abundantly intermixed on scutum, scutellum, and posterior lobe of pronotum, a few black hairs also intermixed on mesepisternum, and fuscous hairs on lower part of mesepisternum; coxae with hairs mostly white, black intermixed apically; hairs of other leg segments black or fuscous, reddish brown on under sides of tarsi, some white hairs on front trochanters, outer edge of hind tibia clothed with white hairs (palest paratype with most of tibial and tarsal hairs white in some lights, fuscous in others); metasomal hairs black, including the dense, plumose, ventral scopa, some whitish hairs in emargination of prepygidial fimbria. Head and thorax with surfaces all dull and finely roughened except for somewhat shining genal and hypostomal areas and median posterior margin of area of propodeum; punctures everywhere fine and separated by several puncture widths, even on clypeus where they are coarsest and somewhat irregular in size; propodeal area longer than scutellum, with fine, weak, inconspicuous, radiating striae which

do not reach margin of area medially but extend beyond margin laterally; carina demarking posterior surface of propodeum extending laterally up nearly to broadly rounded dorsolateral angles of propodeum; metasomal terga shining but minutely transversely lineolate, impunctate. Labrum with keel of process, seen in profile, produced apically and rounded, upper edge not depressed and flattened as in *dampieri*; inner hind tibial spur with four teeth, longer than in *dampieri* but shorter than in *urbanus*.

TYPE MATERIAL: Holotype female and two female paratypes, Mt. Tafa, Papua, 8500 feet altitude, March, 1934 (L. E. Cheesman), in the British Museum (Natural History). Two female paratypes, Daulo Pass, Eastern Highlands District, Northeastern New Guinea, 8200 feet altitude, May 2, 1959 (C. D. Michener), in the Bernice P. Bishop Museum and the Snow Entomological Museum of the University of Kansas.

The red, green, and black coloration is responsible for the specific name.

Chalicodoma (Callomegachile) concolor (Fries)

I have seen no authentically determined specimens of this species, but in the collection of the Department of Agriculture, Stock, and Fisheries, Konedobu (Port Moresby), are specimens agreeing with Fries's description from Hahai Village, Pak Island, Admiralty Islands, June 27, 1956 (J. J. H. Szent-Ivany), and from Talibiga, Gazelle Peninsula, New Britain, 1200 feet altitude (Frank X. Ryan). At the latter locality a nest was found in a house. The nest consisted of a rolled piece of newspaper, irregularly chewed to form some pulp which was also used in making the nest, the whole stuck together by resinous material or possibly merely by sticky provisions. Four adults of both sexes emerged from the nest, and at least two pupae failed to emerge.

Chalicodoma (Callomegachile) kuehni (Fries)

Dr. M. A. Lieftinck sent me the following note on this species: "In September 1948 on Misool Island I found *kuehni* nesting in an old mouldering log in dense forest and reared some females. The tunnels were irregularly arranged, like those of *Lithurge*, and the cells (mostly empty) were only thinly lined with a brittle, non-resinous substance."

Chalicodoma (Callomegachile) szentivanyi,
new species

Plate 15, figure 1

This species is large, entirely black, and superficially has exactly the aspect of the common *Creightonella frontalis*. It differs from that species in the generic characters, such as the absence of cutting edges between the mandibular teeth, and more noticeably in the short clypeus which does not overhang the base of the labrum. It is probably most closely related to *C. (C.) clio* from Celebes. [Friese's record of *clio* from Helmahera in his key is quite likely an error, as no such record is indicated after the description (Friese, 1909).] *Chalicodoma szentivanyi* differs from *C. clio* (which I have not seen) in its entirely fuscous wings and perhaps in its slightly smaller size. Quite likely, when specimens of *clio* are available, other differences will become evident.

FEMALE: Length, 19 mm. (varying to 20 mm.); wing length, 13 mm. Head broader than long, eyes diverging below, with the following relative distances: head width, 12.0; length of eye, 7.5; width of clypeus, 7.0; median length of clypeus, 2.0; distance from lower clypeal margin to upper margin of median ocellus, 6.5. Anterior margin of clypeus not overhanging base of labrum, which is exposed; clypeus not protuberant below, upper part of clypeus and adjacent supraclypeal area somewhat protuberant but clypeal profile virtually straight; anterior margin of clypeus straight medially, broadly convex at each side lateral to base of labrum; interocular distance less than two-thirds of ocellocular distance; genal areas of rather uniform width, narrower than eyes seen from side; preoccipital carina distinct. Mandible four-toothed, all teeth rather short, lower three teeth equidistant, the third a mere convexity, upper tooth more widely separated; mandible approximately parallel sided, less than three times as long as wide, considerably more robust than in the species of *Megachilana*. Pronotal tubercle not carinate; no carina whatever between anterior and lateral faces of mesepisterna. Tibiae without large peglike setae on outer surfaces as in some *Megachilana*; hind basitarsus slightly narrower than tibia. Clypeal punctation coarse, anterior

margin and lateral thirds very shining, with punctures separated by several puncture widths, upper median part with irregular depressions each containing several punctures; hypostomal area and lower part of genal area very coarsely punctate, ground between punctures shining, anterior part of hypostomal area almost impunctate; hypostomal carinae not strongly produced, following margin of proboscis fossa; rest of head very closely and rather finely punctate except for some irregular shiny areas on supraclypeal area; basal third or slightly more of mandible shining, rest dull as usual in the subgenus; scutum and scutellum densely punctate, distinctly more finely so than head, arrangement of punctures in rows not conspicuous except in center of scutum; mesepisternum above with punctures about as large as those of scutum, below surface more shining, punctures larger, irregular, and close, in some lights arrangement in rows evident; metanotum much more finely punctate than scutellum; propodeal triangle minutely granular, basal pitted zone present laterally but not medially; metanotal terga with punctation fine and dense, extending to margins; sterna with punctation coarse, margins impunctate. Pubescence and integument wholly black.

TYPE MATERIAL: Holotype female, Lowland Agricultural Experiment Station, Keravat, near Rabaul, New Britain, June 23, 1954, in house (J. J. H. Szent-Ivany), in the American Museum of Natural History. One female paratype, same locality, June 15, 1954, on road in cacao block (J. J. H. Szent-Ivany), in the British Museum (Natural History). One female paratype, Kangu, Buin Subdivision, south end of Bougainville Island, August 30, 1954, in neglected cocoanut plantation mixed with secondary forest (J. J. H. Szent-Ivany).

All specimens were from the collection of the Department of Agriculture, Stock, and Fisheries, Konedobu (Port Moresby), lent to me by Dr. J. J. H. Szent-Ivany. The last-mentioned paratype has been returned to that collection.

Chalicodoma (Hackeriapis) gilbertiella
Cockerell

The following is the first record for this species, and, together with *C. papuae*, for the

subgenus, outside Australia: Port Moresby, Papua, May 11, 1959 (C. D. Michener).

***Chalicodoma (Hackeriapis) papuae*,
new species**

Plate 15, figure 3

This species is described at this time because it and *C. gilbertiella* provide the first records of the subgenus from New Guinea. This species has the size, form, and coloration of *C. (Rhodomegachile) abdominalis*, from which it differs by the subgeneric characters and even more conspicuously by the elongate, tridentate mandibles of the female. It is most closely related to *C. micrerythrura* from Darwin, Northern Territory, but differs in larger size, the much larger clypeal prominences, and in the eyes which diverge rather than converge below.

FEMALE: Length, 9 mm.; wing length, 6 mm. Head broader than long, anterior orbits with upper and lower portions diverging below, median parts subparallel; head with following relative measurements: width, 19.0; length of eye, 13.0; width of clypeus, 12.0; median length of clypeus, 8.0; distance from lower clypeal margin to upper margin of median ocellus, 13.0. Anterior margin of clypeus not at all overhanging labrum except for small median marginal denticle; lower part of clypeus not protuberant but middle of clypeus, not laterally but in median third, strongly protuberant, the protuberance strongly bilobed, highest ventrolaterally, lower surface at each side slightly concave; anterior margin of clypeus broadly concave and fringed with long yellowish hairs except for median denticle; supraclypeal area broadly convex; interocellar distance slightly greater than ocellocular distance, less than ocellocapital distance; genal area widest medially, about three-fourths as wide as eye seen from side; preoccipital carina absent above, weak below; hypostomal carina weak, longitudinal abscissa much longer than transverse one, a sharp, straight, diagonal carina extending from near anterior (lateral) end of hypostomal carina to posterior end of same. (This may be the true hypostomal carina but does not follow the margin of the proboscival fossa as in most bees.) Mandible distinctly more than twice as long as broad, outer surface in basal two-thirds consisting of two broad dull

channels between three equidistant shining ridges; mandible nearly straight, tapering from base nearly to tridentate apex, median tooth nearer lower than upper tooth. Pronotal lobe weakly carinate; hind basitarsus two-thirds as wide as tibia; second, third, and to a lesser extent fourth, metasomal terga with broad transverse groove immediately behind gradulus. Supraclypeal area medially with coarse punctures, well separated by shining ground; laterally they become finer and closer like those of paraocular areas; upper part of clypeus with punctation similar to that of middle of supraclypeal area, but on and below clypeal protuberances punctation irregular, below protuberances almost absent; sides of clypeus with broad, shallow, close punctures, finer than those of upper part; rest of head with punctures finer than those of center of supraclypeal area and as close as they can be, except that they are progressively coarser on lower genal area and very large, irregular, and coarse on the hypostomal area lateral to diagonal carina; mesad to diagonal carina, surface impunctate but minutely roughened. Scutum and scutellum slightly more finely punctate than vertex, very closely so; mesepisterna more coarsely so, especially below, where punctures are coarser than those of supraclypeal area and as close as possible. Propodeum with basal subhorizontal pitted zone, widest laterally, rest of triangular area granular, coarsely so mid-dorsally, rest of propodeum rather finely and closely punctate except on lower posterior face where punctures are coarser and separated by minutely roughened ground. Metasoma strongly punctate, first tergum most finely so, punctation progressively coarser to fifth tergum, a little finer on sixth; posterior marginal areas of first three terga densely punctured compared to more sparsely punctate anterior portions of terga; last three terga closely punctate throughout. Integument of head and thorax black, under side of flagellum and distitarsi reddish; tibial spurs pale testaceous; outer parts of tegula brownish; wings clear, veins and stigma dark brown; metasoma red, first tergum basally and laterally black. Pubescence dull yellowish, hairs on vertex and scutum largely fuscous or blackish; scutellum and area below wing bases with a few intermixed dark hairs;

posterior margins of metasomal terga 1 to 3 and, laterally, 4, with fasciae of yellowish hairs.

TYPE MATERIAL: Holotype female, Port Moresby area, Papua, October to December, 1946 (L. Jones), from the collection of the Department of Agriculture, Stock, and Fisheries, Port Moresby, in the American Museum of Natural History.

Chalicodoma (Hackeriapis) semiluctuosa
(Smith)

Megachile semi-luctuosa SMITH, 1853, p. 172.

Megachile blackburnii FROGGATT, 1893, p. 72. New synonymy.

Because of confusing circumstances concerning the type of *blackburnii*, I have de-

viated from the general practice for this paper of saying little about specific names and synonyms. Froggatt described this species from three "females" and one male. The latter was readily found in the South Australian Museum, labeled "♂ type W. W. F." However, the description was based almost entirely on the "female," one of which was ultimately found labeled in Froggatt's hand as the female type of *Thynnus blackburnii* Froggatt. He named no such *Thynnus*, and this generic assignment is obviously a *lapsus*. The specimen is in reality a male of *C. semiluctuosa*; it agrees with Froggatt's description of his "female" and is here designated, and has been labeled, as the lectotype of *Megachile blackburnii* Froggatt.

APPENDIX 3. DERIVATIONS OF THE NEW GENERIC AND SUBGENERIC NAMES

THE INTERNATIONAL COMMISSION on Zoological Nomenclature recommends that the origins of new names be given. The derivations of the new generic and subgeneric names are therefore listed below, with the gender of each indicated in parentheses. The origins of new specific names are indicated in Appendix 2.

- Hoplocolletes*: Shield, plus *Colletes*, in reference to the coarsely rugose scutum (masc.).
Nesocolletes: Island, plus *Colletes* (from New Zealand) (masc.).
Microcolletes: Small, plus *Colletes* (masc.).
Excolletes: Without, plus *Colletes*, in reference to the absence of basitibial plates (masc.).
Colletopsis: *Colletes*-like (masc.).
Urocolletes: Tail, plus *Colletes*, in reference to the brightly colored apex of the abdomen (masc.).
Anacolletes: Again, plus *Colletes* (masc.).
Glossurocolletes: Tongue, plus tail, plus *Colletes*, in reference to the ligulate processes of the eighth sternum (masc.).
Ceratocolletes: Horn, plus *Colletes*, in reference to the modified antennae of the males (masc.).
Baeocolletes: Little, plus *Colletes* (masc.).
Colletellus: Diminutive of *Colletes* (masc.).
Chrysocolletes: Gold, plus *Colletes*, in reference to the golden pubescence (masc.).
Hesperocolletes: Western, plus *Colletes* (masc.).
Callocolletes: Beautiful, plus *Colletes* (masc.).
Euhesma: True, plus bees (fem.), introduced for this large and probably phylogenetically basic group of the Euryglossinae to provide a root (*hesma*) for the construction of euryglossine names.
Dermatohesma: Skin, plus bees, in reference to the strongly (for the group) punctured cuticle (fem.).
Parahesma: Near, plus bees (fem.).
Callohesma: Beautiful, plus bees (fem.).
Xenohesma: Strange, plus bees (fem.).
Xanthhesma: Yellow, plus bees (fem.).
Heterohesma: Different, plus bees (fem.).
Stenohesma: Slender, plus bees (fem.).
Holohesma: Whole, plus bees (fem.).
Dasyhesma: Hairy, plus bees (fem.).
Hypshesma: Under, plus bees (fem.), in reference to the mesad projection of the lower ends of the eyes, so that the mandibles are under the eyes.
Pachyprosopula: Diminutive of *Pachyprosopis* (fem.).
Pachyprosopina: Diminutive of *Pachyprosopis* (fem.).
Euryglossula: Diminutive of *Euryglossa* (fem.).
Brachyhesma: Short, plus bees (fem.).
Microhesma: Small, plus bees (fem.).
Edriohylaeus: Small, plus *Hylaeus* (masc.).
Rhodohylaeus: Red, plus *Hylaeus* (masc.).
Hylaeteron: Modification of *Hylaeus* (masc.).
Gnathoprosopoides: Like *Gnathoprosopis* (masc.).
Euprosopoides: Like *Euprosopis* (masc.).
Euprosopellus: Diminutive of *Euprosopis* (masc.).
Macrohylaeus: Large, plus *Hylaeus* (masc.).
Xenohylaeus: Strange, plus *Hylaeus* (masc.).
Gephyrohylaeus: Bridge, plus *Hylaeus*, in reference to existence on the bridge between Asia and Australia (masc.).
Pharohylaeus: Cloak, plus *Hylaeus*, with reference to large, basal, abdominal segments which nearly hide the apical segments (masc.).
Hylaeorhiza: *Hylaeus*, plus root, in reference to the *Hylaeus*-like base of the *Palaeorhiza* line (fem.).
Xenorrhiza: Peculiar, plus root (reference to *Palaeorhiza*) (fem.).
Anchirrhiza: Near, plus root (reference to *Palaeorhiza*) (fem.).
Hemirrhiza: Half, plus root (reference to *Palaeorhiza*) (fem.).
Amphylaeus: Both, plus root (reference to *Palaeorhiza*) (masc.).
Agogenohylaeus: Leading away from *Hylaeus* (masc.).
Austronomia: Southern, plus *Nomia* (fem.).
Pilonomia: Feather, plus *Nomia*, in reference to plumose hairs (fem.).
Australictus: Southern, plus *Halictus* (masc.).
Pseudochilalictus: False, plus *Chilalictus* (masc.).
Callalictus: Beautiful, plus *Halictus* (masc.).
Austrevylaeus: Southern, plus *Evyllaeus* (masc.).
Glossalictus: Tongue, plus *Halictus* (masc.).
Chilalictus: Lip, plus *Halictus*, in reference to the peculiar labrum (masc.).
Eumegachilana: *Eumegachile*, plus again (fem.).
Schizomegachile: Split, plus *Megachile*, in reference to the divided sixth sternum of the male (fem.).
Rhodomegachile: Red, plus *Megachile* (fem.).
Austrochile: Southern, plus lip (reference to *Megachile*) (fem.).
Mitchellapis: Mitchell, plus bee, dedicated to T. B. Mitchell (fem.).
Brevineura: Short, plus vein, in reference to the short vein C_1 (fem.).

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ADDENDA

1. ON PAGE 33, in the Key to the Families, couplet 4, and in the Artificial Key, couplet 4, the genus *Ctenoplectra* and its family, Melittidae, are segregated from other groups partly on the basis of the crescentic, comb-like, inner hind tibial spur. This is a character of females only. An additional character of both sexes is the gradual curvature of the apical half of the marginal cell away from the costal margin of the forewing (fig. 639).

2. A large female specimen of *Hylaeus*, superficially similar to the subgenus *Euprosopis*, group *a*, was recently sent me for study by E. F. Riek of the Commonwealth Scientific and Industrial Research Organization. It has the propodeal structure of the subgenus *Euprosopellus* but does not have the dorsal swellings of the first two metasomal terga, with a constriction between them, as described for that subgenus. As *Euprosopellus* is known to me only in the male sex, it now seems likely that the tergal swellings are characteristic of males and are not necessarily possessed by females. In this case adjustments should be made in the key to subgenera (p. 118) and in the description of *Euprosopellus* (p. 132). Nevertheless, *Euprosopellus* remains a striking and distinctive subgenus.

3. Re-examination of specimens has shown the need for corrections of the treatment of *Lasioglossum*, *sensu stricto* (pp. 171-173). *Pachyhalictus* is not a synonym of *Lasioglossum* proper but is a distinct genus or subgenus characterized by strong apical wing veins and other distinctive features, as explained in detail by Blüthgen (1926) for his group of "*Halictus nomiiformes*." The species in our area are *Pachyhalictus stirlingi* (Cockerell, 1910a), *buruanus* (Blüthgen, 1926), and

trizonulus (Friese, 1909). Other species are *P. vinctus* (Walker), *kalutarae* (Cockerell), *reticulosus* (Dalla Torre), and *sigiriellus* (Cockerell).

It is now clear that the remaining extralimital forms listed in the last paragraph on *Lasioglossum* proper (p. 173) can probably advantageously be separated from the subgenus *Lasioglossum*, and that the name *Ctenonomia* Cameron (1903, Jour. Straits Branch, Roy. Asiatic Soc., vol. 39, p. 178) is available for this group. *Ctenonomia* differs from *Lasioglossum* proper in its short, robust form, the pectinate inner hind tibial spur of the female, the short, broad process of the labrum of the female, and other characters. Studies now being made will hopefully permit more accurate delimitation of this subgenus.

The Australian species listed on pages 172 and 173 and discussed in numbered paragraphs 2 and 3 on page 172 are inadequately known for certain placement (only one incomplete male specimen is available for the whole group), but if one must attribute them to a named subgenus, they fall best in *Ctenonomia*.

4. In the discussion of variation in *Homalictus* (pp. 178 and 179), it should have been said that *H. maitlandi* is unusually robust, having the body form of a *Ctenonomia*. Moreover, it has what appear superficially to be basal bands of white tomentum on the second and third metasomal terga and is the only *Homalictus* with such fasciae. In reality these bands are made up of elongated plumose hairs of the gradular fringe, so are not homologous to normal tomentum which in the genus *Lasioglossum* is made up of plumose hairs arising from the general tergal surfaces.

INDEX

SPECIFIC AND SUBSPECIFIC names are given with endings appropriate to the genders of the genera in which they are now placed. Persons desiring to know the current generic placement of such a name should understand that it may appear here with a different termination than the original one because of the anachronistic requirement of agreement in gender with the generic name.

Specific and subspecific names are treated alike in this index, as in the text (see Methods and Explanations of Symbols, pp. 25–26). New names appear in bold-faced type.

Abbreviations, 26

abdominalis, *Chalicodoma*, 202, 242
abdominalis, *Leioproctus*, 41, 66
abdominalis, *Parevaspis*, 214
abdominis, *Leioproctus*, 39, 41
abnormis, *Euryglossa*, 92
abnormis, *Leioproctus*, 39, 50, 68
absonulum, *Anthidiellum*, 213
abstrusa, *Exoneura*, 226
abuensis, *Nomia*, 159
acaciae, *Leioproctus*, 68
accipitris, *Hylaeus*, 123
Acentron, 206
Acknowledgments, 5
Acunomia, 152
acutiventris, *Megachile*, 186
adamsella, *Amegilla*, 216
adelaidae, *Amegilla*, 216
adelaidae, *Euryglossa*, 94
adelaidae, *Lasioglossum*, 167
adelaidae, *Melittosmithia*, 99
adelaidae, *Megachile*, 186
adelaidella, *Nomia*, 156
adonidiae, *Homalictus*, 181
adumbrata, *Xylocopa*, 228
advena, *Leioproctus*, 50, 233
Aeganopria, 41
aenea, *Nomia*, 156
aenescens, *Nomia*, 156
aeneus, *Leioproctus*, 41
aenigmatica, *Apis*, 232
aerata, *Nomia*, 156
aeratus, *Lestis*, 228
aeruginosa, *Amegilla*, 216
aestuans, *Xylocopa*, 228
aethiops, *Chalicodoma*, 193
agilis, *Hylaeus*, 123
Agogenohylaeus, 148, 324
alani, *Chalicodoma*, 197
albescens, *Lasioglossum*, 173

albiceps, *Amegilla*, 217
albiceps, *Chalicodoma*, 191
albiceps, *Coelioxys*, 213
albifrons, *Creightonella*, 206
albifrons, *Thyreus*, 218
albigena, *Amegilla*, 217
albigenella, *Amegilla*, 217
albilabris, *Ceratina*, 220
albipes, *Hylaeus*, 129
albobasalis, *Chalicodoma*, 191
albocincta, *Hyleoides*, 151
albocuneatus, *Hylaeus*, 136, 238
albofasciata, *Nomia*, 154
albofimbriatus, *Lithurge*, 185
alboguttatum, *Lasioglossum*, 175
albolateralis, *Thyreus*, 219
albolineata, *Coelioxys*, 212
albolineata, *Exoneura*, 225
albomaculata, *Thyreus*, 218
albomaculatus, *Hylaeus*, 136
albomarginata, *Megachile*, 209
albomarginatus, *Ctenocolletes*, 83, 266
albonitens, *Hylaeus*, 129
albopictus, *Thyreus*, 218
albopilosa, *Exoneura*, 226
albopilosus, *Leioproctus*, 66
alboscopacea, *Nomia*, 156
albosignata, *Euryglossa*, 94
albovittatus, *Leioproctus*, 55
albovittatus, *Thyreus*, 218
albozebratus, *Hylaeus*, 123, 289
alcyonius, *Hylaeus*, 133
alecto, *Creightonella*, 205
Alfkenella, 216
alienus, *Leioproctus*, 50
alismatis, *Leioproctus*, 41
alleynae, *Chalicodoma*, 197
alleynae, *Leioproctus*, 50
Allodapula, 221
alopex, *Leioproctus*, 41
alpha, *Amegilla*, 217
altichum, *Lasioglossum*, 167
altitudinis, *Euryglossa*, 91
amabilis, *Leioproctus*, 50
amalihea, *Trigona*, 230
amatiformis, *Hylaeus*, 130
amatulus, *Hylaeus*, 123
amatus, *Hylaeus*, 132
amboinense, *Lasioglossum*, 172
amboinensis, *Megachile*, 186
amboinensis, *Nomia*, 154, 156
amboinensis, *Sphecodes*, 182
amboinensis, *Thyreus*, 218
Amegachile, 206
Amegilla, 215, 216
amiculiformis, *Hylaeus*, 129

- amiculinus*, *Hylaeus*, 129, 237
amiculus, *Hylaeus*, 129
Amphylaeus, 147, 149, 324
Anacolletes, 59, 324
Analastoroides, 139
analis, *Nomia*, 156
Anchirhiza, 147, 324
ancoratus, *Hylaeus*, 126
andinus, *Leioproctus*, 41
andreniformis, *Leioproctus*, 64
andrennina, *Nomia*, 159
Andrenopsis, 71
Androgynella, 206
anexoneuroides, *Lasioglossum*, 175
angophorae, *Exoneura*, 226
angophorae, *Pachyprosopis*, 106
angophorae, *Trigona*, 231
angophorella, *Exoneura*, 226
angulata, *Inquilina*, 226
angulifera, *Pachyprosopis*, 107
anhybodinum, *Lasioglossum*, 167
annae, *Megachile*, 209
annexum, *Lasioglossum*, 167
annulata, *Hylaeus*, 117
anomala, *Amegilla*, 217
anomala, *Nomia*, 157
anomalum, *Lasioglossum*, 170
antennata, *Euryglossa*, 94
antennata, *Nomia*, 157
antennatus, *Leioproctus*, 64
Anihemois, 206
Anthidiini, 213
Anthidiellum, 213
Anthoglossa, 78
Anthophora, 215
Anthophoridae, 214
Anthophorinae, 214
Anthophorini, 215
anthracocephala, *Euryglossa*, 91
antipodes, *Callomelitta*, 38
antipus, *Callomelitta*, 38
Aphalictus, 165
Apiarus, 231
apicalis, *Euryglossa*, 94
apicalis, *Leioproctus*, 50
apicalis, *Trigona*, 231
apicata, *Chalicodoma*, 191, 197
apicata, *Coelioxys*, 212
apicata, *Palaeorhiza*, 145
Apicula, 231
Apidae, 229
Apinae, 229
Apini, 231
Apis, 231
Apoidea, classification of, 8, 33; definition of, 8;
 habits of, 8, 9; parasitic, 9
aponi, *Homalictus*, 179
aposuarius, *Hylaeus*, 132
apposita, *Chalicodoma*, 187, 197
apposita, *Exoneura*, 226
appositus, *Homalictus*, 179
aptum, *Lasioglossum*, 175
aralis, *Hylaeus*, 123
Archimegachile, 187
arciferum, *Lasioglossum*, 167
areolatus, *Homalictus*, 179
argentita, *Megachile*, 206
argentifer, *Chalicodoma*, 197
argentifrons, *Leioproctus*, 66
argentifrons, *Nomia*, 156
Argyropile, 206
armatus, *Leioproctus*, 41
arnau, *Leioproctus*, 41
arnoldi, *Amphylaeus*, 148
armstrongi, *Megachile*, 209
 Artificial key, 33
aruana, *Xylocopa*, 228
Asaropoda, 217
asimillima, *Exoneura*, 226
asinellus, *Hylaeus*, 129
aspasius, *Thyreus*, 218
asperithorax, *Hylaeus*, 123
asperithorax, *Lasioglossum*, 175
aspidopodum, *Anthidiellum*, 213
asserta, *Amegilla*, 216
assertiella, *Amegilla*, 216
assimilis, *Creightonella*, 205
associata, *Allodapula*, 223
aterrima, *Chalicodoma*, 191
aterrima, *Exoneura*, 225, 242
atomaria, *Euryglossina*, 109
atra, *Thyreus*, 218
atrata, *Creightonella*, 206
atrata, *Trigona*, 231
atratformis, *Lithurge*, 185
atratus, *Lithurge*, 185
atrella, *Chalicodoma*, 197
atricornis, *Trigona*, 231
atripes, *Trigona*, 231
atrocyaneum, *Lasioglossum*, 175, 239
atromicans, *Hyphesma*, 105
atronitens, *Lasioglossum*, 167
atronitens, *Leioproctus*, 50
atrorufescens, *Lasioglossum*, 167
aurantiaca, *Megachile*, 186
aurantiacum, *Lasioglossum*, 170
aurantifer, *Nomia*, 154
aurantifera, *Euryglossa*, 95
aurantipes, *Pachyprosopis*, 106, 235
aurantiscopa, *Megachile*, 209
aurata, *Amegilla*, 216
aurata, *Ceratina*, 221
aurata, *Nomia*, 157
aureoazureus, *Homalictus*, 179
aureohirta, *Nomia*, 159
aureomaculata, *Euryglossa*, 94

- aureomaculata*, *Hylaeorhiza*, 142
aureopicta, *Euryglossa*, 95
aureopictus, *Hylaeus*, 127, 236
aureopilosa, *Euryglossa*, 94
aureotinctus, *Trichocolletes*, 79
aurescens, *Euryglossa*, 94
aurescens, *Leioproctus*, 66
auriceps, *Chalicodoma*, 191
auriferus, *Hylaeus*, 123
aurifrons, *Chalicodoma*, 197
aurifrons, *Leioproctus*, 66
aurifrons, *Nomia*, 159
austeni, *Megachile*, 209
australasiae, *Megachile*, 209
australensis, *Ceratina*, 221
australensis, *Lestis*, 228
australensis, *Nomada*, 214
australensis, *Thyreus*, 218
Australia, 9, 11, 21
australiaca, *Nomia*, 156
australica, *Ctenoplectra*, 184
australica, *Nomia*, 156, 239
Australictus, 165, 324
australiensis, *Leioproctus*, 68
australis, *Amegilla*, 216
australis, *Euryglossa*, 91, 268
australis, *Megachile*, 209
australis, *Nomia*, 161
australis, *Paracolletes*, 78
australis, *Trigona*, 230, 244
Austrevylaeus, 170, 324
Austrochile, 202, 324
Austromegachile, 206
Austronomia, 156, 324
Austroplebeia, 230
austrovagans, *Nomia*, 156
axillaris, *Chalicodoma*, 197

babindensis, *Nomia*, 156
bacchalis, *Leioproctus*, 50
bacillaria, *Heterapoides*, 138
baculifera, *Exoneura*, 226, 243
baeckiae, *Leioproctus*, 68
Baeocolletes, 70, 324
bagudai, *Palaeorhiza*, 145
barbata, *Hyphesma*, 105, 234
barretti, *Lasioglossum*, 172
barvonensis, *Chalicodoma*, 197
basalis, *Hylaeus*, 130
basalis, *Parevaspis*, 213
basilautum, *Lasioglossum*, 167
basilautus, *Hylaeus*, 123
basilucens, *Lasioglossum*, 175
basilura, *Palaeorhiza*, 145
basipicta, *Nomia*, 159
basirufus, *Leioproctus*, 41
bassi, *Lasioglossum*, 175
basutorum, *Nomia*, 159

batchelori, *Megachile*, 212
baudiniensis, *Homalictus*, 179
baudiniensis, *Hylaeus*, 123
baudini, *Lasioglossum*, 175
baxteri, *Exoneura*, 226
beatissimus, *Thyreus*, 218
behri, *Homalictus*, 179
bellula, *Creightonella*, 206
Belopria, 41
berylae, *Amegilla*, 216
beutenmulleri, *Chalicodoma*, 197
bicarinata, *Nomia*, 159
bicellularis, *Leioproctus*, 41
bicincta, *Exoneura*, 226
bicingulatum, *Lasioglossum*, 175
Bicolletes, 41
bicolor, *Euryglossa*, 94
bicolor, *Euryglossina*, 109
bicolor, *Exoneura*, 226, 243
bicolor, *Leioproctus*, 50, 68
bicolor, *Megachile*, 210
bicoloratus, *Hylaeus*, 123, 129
bicolorellus, *Hylaeus*, 129
Bicornelia, 42
bicristatus, *Leioproctus*, 50
bicuneatus, *Hylaeus*, 123
bidentata, *Nomia*, 160
bidentatus, *Hylaeus*, 123
Biglossa, 41
Biglossidia, 41
biguttata, *Nomada*, 214
bilobatus, *Leioproctus*, 61, 253
bimaculatus, *Leioproctus*, 59
Binghamiella, 37
 Biogeographical considerations, 9
bipectinatus, *Leioproctus*, 54, 233
biroi, *Allodapula*, 223
biroi, *Anthidiellum*, 213
biroi, *Chalicodoma*, 191
biroi, *Coelioxys*, 212
biroi, *Lasioglossum*, 174
biroi, *Nomada*, 214
biroi, *Sphecodes*, 182
biroi, *Trigona*, 231
 Bismarck Archipelago, 17, 18, 25
bispinosa, *Ceratina*, 220
bituberculata, *Nomia*, 160, 306
bituberculatus, *Hylaeus*, 127
bitulnerata, *Hyleoides*, 151, 238
blackburni, *Homalictus*, 179
blackburnii, *Chalicodoma*, 197, 323
blanchae, *Hylaeus*, 123
blanda, *Euryglossa*, 96
blandulum, *Lasioglossum*, 173
blighi, *Lasioglossum*, 175
boharti, *Allodapula*, 223
boliviensis, *Leioproctus*, 41
boltoni, *Leioproctus*, 50

- bombiformis*, *Amegilla*, 217
bombiliformis, *Lestis*, 228
Bombinae, 229
Bombus, 229
bombylans, *Lestis*, 228, 243
borchii, *Hylaeus*, 127
borneana, *Nomia*, 154
boroniae, *Leioproctus*, 50
botanica, *Exoneura*, 225
botanicus, *Homalictus*, 179
bougainvillei, *Chalicodoma*, 204
bougainvilliana, *Megachile*, 210
bouvieri, *Leioproctus*, 41
boweni, *Lasioglossum*, 175
brachycera, *Xanthosma*, 97
Brachyglossa, 41
Brachyglossula, 41
Brachyhesma, 112, 114, 324
bractipes, *Lithurge*, 185
brazieri, *Lasioglossum*, 175
bremensis, *Homalictus*, 179
brevicornis, *Paracolletes*, 78
Brevineura, 224, 324
brevior, *Hylaeus*, 123
bribiense, *Lasioglossum*, 167
bribiensiforme, *Lasioglossum*, 167
bribiensis, *Ceratina*, 221
brisbanensis, *Exoneura*, 225, 242
brisbanensis, *Homalictus*, 179
brisbanensis, *Nomia*, 156, 239
bruneri, *Leioproctus*, 41
bryorum, *Xylocopa*, 228
bryotrichum, *Lasioglossum*, 167
buccinus, *Homalictus*, 178
burkei, *Homalictus*, 179
burmica, *Nomia*, 159
burnsi, *Hylaeorhiza*, 142, 300
burnsi, *Trichocolletes*, 79, 263
bursariae, *Lasioglossum*, 175
buruana, *Xylocopa*, 228
buruanum, *Lasioglossum*, 173
buruanus, *Pachyhalictus*, 338
buruensis, *Amegilla*, 216
buruensis, *Homalictus*, 179
butleri, *Hylaeus*, 130
butleri, *Lasioglossum*, 167
butonensis, *Megachile*, 210
buxtoni, *Megachile*, 209

caeruleae, *Trigona*, 230
caerulea, *Xylocopa*, 228
caeruleifrons, *Thyreus*, 218
caeruleopunctatus, *Thyreus*, 218
caeruleotinctus, *Leioproctus*, 63, 233
caerulescens, *Leioproctus*, 41, 50
caerulescens, *Nomia*, 153
caerulescens, *Palaeorhiza*, 145
calcaratus, *Leioproctus*, 70, 257

calens, *Megachile*, 209
calida, *Chalicodoma*, 197
californiensis, *Nomia*, 153
Callalictus, 170, 324
callander, *Paracolletes*, 78
callaspis, *Homalictus*, 179
callichlora, *Nomia*, 156
callopsella, *Euryglossa*, 95
callopsiformis, *Euryglossa*, 95, 234
Callochile, 210
Callocolletes, 80, 324
Callohesma, 89, 91, 95, 324
Callomegachile, 188
Callomelitta, 37
callomelittinum, *Lasioglossum*, 170
callosa, *Prosopis*, 117
Callosphcodes, 183
callura, *Chalicodoma*, 197
callurus, *Leioproctus*, 59
calophyllae, *Lasioglossum*, 175
caloundrensis, *Homalictus*, 179
calva, *Amegilla*, 217
camagei, *Lasioglossum*, 175
camournii, *Euryglossa*, 95
camournii, *Holohesma*, 102
cameroni, *Hylaeus*, 123
campbelli, *Euryglossa*, 95
canaliculata, *Meroglossa*, 150
canifrons, *Chalicodoma*, 197
canifrons, *Trigona*, 231
capillatus, *Leioproctus*, 50
capitatus, *Hylaeus*, 130
capitonis, *Megachile*, 209
capitosus, *Hylaeus*, 123
carbonaria, *Trigona*, 231, 243
carbonarium, *Lasioglossum*, 167
carinata, *Melittosmithia*, 99
carinatifrons, *Leioproctus*, 54
carinatus, *Leioproctus*, 50
carinatulus, *Leioproctus*, 50
carinicolis, *Nomia*, 159
carinifrons, *Chalicodoma*, 191
carnosa, *Euryglossa*, 95
carolinensis, *Homalictus*, 181
caroli, *Homalictus*, 181
cartereti, *Megachile*, 210
carteri, *Chalicodoma*, 204
cassiae, *Hylaeus*, 132
cassiae, *Trigona*, 230
cassiaeiflora, *Homalictus*, 179
cassiaeiflora, *Palaeorhiza*, 145
castaneipes, *Leioproctus*, 50
castaneipes, *Megachile*, 186
catanii, *Euryglossa*, 87
cattulum, *Lasioglossum*, 173
cearenensis, *Leioproctus*, 41
Cellaria, 183
Cellariella, 183

- celmisiae*, *Pachyprosopis*, 87
ceniberus, *Hylaeus*, 126, 236
centralis, *Hylaeus*, 123
centuncularis, *Megachile*, 206
cephalochilum, *Lasioglossum*, 175, 239, 314
cephalotes, *Chalicodoma*, 191
ceramensis, *Xylocopa*, 228
cerena, *Apis*, 232
Ceratias, 206
Ceratina, 220
ceratina, *Nomia*, 159
Ceratinidia, 221
Ceratinini, 219
Ceratinula, 220
Ceratocolletes, 63, 324
Ceri-anthidium, 213
certus, *Hylaeus*, 132
cervicale, *Lasioglossum*, 167, 239
cestri, *Leioproctus*, 41
cetera, *Megachile*, 209
Ceyalictus, 183
chalceus, *Dasycolletes*, 37
chalcosoma, *Euryglossula*, 112, 236
chalcurus, *Leioproctus*, 50
Chalicodoma, 187
Chalicodomoides, 192
chalybaea, *Leioproctus*, 51
chalybaeus, *Hylaeus*, 134
chalybaeus, *Leioproctus*, 41
chalybea, *Ctenoplectra*, 184
chalybeata, *Nomia*, 153, 154
chalybeatus, *Leioproctus*, 50
chapmani, *Lasioglossum*, 175
Chatham Islands, 122
cheesmanae, *Chalicodoma*, 191
cheesmanae, *Nomia*, 156
Chelostomoda, 203
Chelostomoides, 187
Chilalictus, 174, 324
Chilicolinae, 114
chiropterina, *Meroglossa*, 150
Chloralictus, 163
chlorocyanea, *Amegilla*, 216
chlorosomus, *Hylaeus*, 123
chlorura, *Callomelitta*, 38
chromaticus, *Hylaeus*, 129, 237
chrysaspis, *Hylaeus*, 130
chrysoceras, *Euryglossa*, 94, 234
Chrysocolletes, 71, 324
chrysognathus, *Hylaeus*, 130
chrysopyga, *Megachile*, 209, 242
chrysopygopsis, *Megachile*, 209
Chrysosarus, 206
chrysostomus, *Leioproctus*, 41
chrysostomus, *Trichocolletes*, 79
chyzeri, *Megachile*, 209
ciliatipes, *Megachile*, 209
cincta, *Nomia*, 161
cincta, *Trigona*, 230
cincticornis, *Euryglossa*, 94
cinctofemorata, *Amegilla*, 216
cincturata, *Chalicodoma*, 191
cinereus, *Leioproctus*, 50
cingulata, *Amegilla*, 216
cingulata, *Megachile*, 209
cingulatus, *Leioproctus*, 41
cingulatus, *Leioproctus*, 41
circumdatum, *Lasioglossum*, 175
cirriiferum, *Lasioglossum*, 167
Cladocerapis, 54
cladocerus, *Leioproctus*, 54
clarigaster, *Lasioglossum*, 167, 239
claripes, *Homalictus*, 179
clarissima, *Allodapula*, 223
clarissima, *Exoneura*, 225
claristigma, *Euryglossula*, 112
clariventris, *Lasioglossum*, 175
clarki, *Chalicodoma*, 193
clarki, *Leioproctus*, 50
clarum, *Lasioglossum*, 173
clarus, *Leioproctus*, 66
clavata, *Nomia*, 159
Clavicera, 220
clavipes, *Trigona*, 231
clelandi, *Lasioglossum*, 175
cliffordi, *Chalicodoma*, 187, 197
cliffordiella, *Exoneura*, 225
cliffordiellus, *Hylaeus*, 123
clio, *Chalicodoma*, 191
clotho, *Chalicodoma*, 192
clypearis, *Euryglossa*, 96, 278
clypeata, *Chalicodoma*, 197
clypeata, *Heterohesma*, 98
clypeata, *Nomia*, 157
clypearis, *Trigona*, 231
clypeatus, *Leioproctus*, 54
cockerelli, *Euryglossina*, 109
cockerelli, *Trigona*, 230
codenticalis, *Homalictus*, 179
Coelioxys, 212
cognatum, *Lasioglossum*, 175
cognatus, *Hylaeus*, 130
cognatus, *Lithurge*, 185
colei, *Hylaeus*, 126
collaris, *Hyleoides*, 151
Collecting data, 233
Colletellus, 70, 324
colletellus, *Leioproctus*, 66
Colletidae, 35
Colletinae, 35
Colletopsis, 58, 324
colmani, *Leioproctus*, 54
colonicum, *Lasioglossum*, 175
colorata, *Brachyhesma*, 114
coloratipes, *Leioproctus*, 41
comberi, *Nomia*, 159

- combinata*, *Xylocopa*, 228
conaminis, *Megachile*, 212
concava, *Inquilina*, 226
concinna, *Hyleoides*, 151, 238
concinnulla, *Exoneura*, 225, 242
concinnulla, *Hyleoides*, 151
concolor, *Chalicodoma*, 191, 320
concorda, *Palaeorhiza*, 145
confusa, *Amegilla*, 216
confusa, *Hylaeus*, 132
confusellum, *Lasioglossum*, 175
confusus, *Leioproctus*, 50
conica, *Coelioxys*, 212
conica, *Palaeorhiza*, 145, 301
consanguinea, *Creightonella*, 204
conspicua, *Palaeorhiza*, 145
conspicuum, *Lasioglossum*, 175
constrictiformis, *Hylaeus*, 126
constrictus, *Hylaeus*, 126, 236
contaminatum, *Lasioglossum*, 170
contrarius, *Leioproctus*, 58, 252
convexum, *Lasioglossum*, 175
convictus, *Paracolletes*, 78
cooki, *Brachyhesma*, 114, 287
Coptorthosoma, 228
cornifera, *Chalicodoma*, 199
cornuta, *Euryglossina*, 111, 235
coronata, *Xylocopa*, 228
coronatulus, *Hylaeus*, 126
coronatus, *Hylaeus*, 126, 236
coventryi, *Euryglossa*, 94
crabronica, *Euryglossa*, 91
crassifemoratus, *Hylaeus*, 123
crassior, *Hylaeus*, 123
crassipes, *Dasycolletes*, 37
crassipes, *Paracolletes*, 78, 233
Creightonella, 204
crenulatus, *Leioproctus*, 40, 73, 233, 261
Cressoniella, 206
cretinicolus, *Homalictus*, 179
crinitus, *Homalictus*, 180
cristariae, *Leioproctus*, 41
cristatus, *Leioproctus*, 50
Crocisa, 218
Crocissa, 218
crotalariae, *Homalictus*, 180
ctenander, *Homalictus*, 180, 318
Ctenocolletes, 83
Ctenonomia, 338
Ctenoplectra, 183, 338
Ctenoplectrinae, 183
Ctenosibyne, 41
cuneata, *Nomia*, 156
cupreochalybea, *Euryglossa*, 94
cupreus, *Leioproctus*, 50
Curvinomia, 153, 154
curvipes, *Leioproctus*, 66
curvipes, *Nomia*, 152, 154
cyarella, *Nomia*, 156
cyaneomicans, *Hylaeus*, 123, 289
cyaneorufus, *Leioproctus*, 50
cyanescens, *Callomelitta*, 39
cyanescens, *Leioproctus*, 68
cyaneus, *Leioproctus*, 41
cyaniventris, *Prosopis*, 117
cyanophilus, *Hylaeus*, 123
cyanurus, *Hylaeus*, 132
cyanurus, *Leioproctus*, 50
cyclognathum, *Lasioglossum*, 176
cyclurum, *Lasioglossum*, 173
cygnellus, *Leioproctus*, 68
cygni, *Amegilla*, 218
cygni, *Paracolletes*, 78
cygnorum, *Megachile*, 209
Cyphopyga, 206
Dactylomegachile, 206
dahli, *Nomada*, 214
dalbertsi, *Xylocopa*, 228
dampieri, *Homalictus*, 180, 241
dampieri, *Megachile*, 209
darwinensis, *Coelioxys*, 212
darwinensis, *Homalictus*, 180
darwini, *Amegilla*, 216
darwini, *Thyreus*, 218
darwiniana, *Megachile*, 209
darwiniellum, *Lasioglossum*, 176
darwinorum, *Nomia*, 156
Dasycolletes, 47
Dasyhesma, 91, 102, 324
Dasymegachile, 206
davaonensis, *Chalicodoma*, 191
daveyi, *Hylaeus*, 130
davide, *Lasioglossum*, 165
daviesiae, *Trichocolletes*, 79
dawsoni, *Amegilla*, 218
dawsoni, *Inquilina*, 226
deanii, *Chalicodoma*, 202, 242
deceptor, *Meroglossa*, 150
deceptrix, *Leioproctus*, 41
decipiens, *Coelioxys*, 212
decipiens, *Meroglossa*, 150
decoloratus, *Leioproctus*, 41
deesanum, *Lasioglossum*, 173
delicata, *Heterapoides*, 138
Delomegachile, 206
demissus, *Homalictus*, 180
denoiti, *Trigona*, 230
dentata, *Amegilla*, 218
dentata, *Nomia*, 161
dentatus, *Leioproctus*, 63
denticauda, *Palaeorhiza*, 146
dentiger, *Leioproctus*, 63
dentipes, *Ceratina*, 221
dentipes, *Lithurge*, 185
dentiventris, *Amegilla*, 218

- dentiventris*, *Nomia*, 156
depressa, *Euryglossa*, 94
derelecta, *Chalicodoma*, 197
Dermatohesma, 91, 324
Derotropis, 206
desponsa, *Meroglossa*, 150
detersa, *Megachile*, 209
dichaeta, *Brachyhesma*, 114, 287
Digronoceras, 187
dimidiata, *Xylocopa*, 228
diminuta, *Allocapula*, 223
dimissa, *Nomia*, 156
dimorphum, *Lasioglossum*, 176
dinognatha, *Chalicodoma*, 197
diodontus, *Leioproctus*, 63
disclusum, *Lasioglossum*, 176
disconota, *Xylocopa*, 228
disjuncta, *Chalicodoma*, 191
disjuncta, *Meroglossa*, 150
disjunctiformis, *Chalicodoma*, 191
disjunctus, *Hylaeus*, 130, 237
dispersa, *Coelioxys*, 212
disputabilis, *Megachile*, 209
disrupta, *Palaeorhiza*, 146
dissimulator, *Lasioglossum*, 167
distractus, *Hylaeus*, 123
diversipes, *Exoneura*, 226
diversipes, *Nomia*, 157
diversipuncta, *Meroglossa*, 150
dives, *Trichocolletes*, 79
dixonii, *Homalictus*, 180
doanei, *Megachile*, 209
doddi, *Euryglossina*, 109
doddi, *Lasioglossum*, 167
doddi, *Nomia*, 156
doddi, *Pachyprosopis*, 106
doddiana, *Chalicodoma*, 193
doleschalli, *Megachile*, 209
dolichocephala, *Euryglossa*, 91
dolichocercum, *Lasioglossum*, 176
dolorosus, *Homalictus*, 181
dolosus, *Leioproctus*, 66, 256
dorsata, *Apis*, 231
dorsicyaneum, *Lasioglossum*, 176
dotatus, *Homalictus*, 180, 241
douglasi, *Hesperocolletes*, 76, 262
douglasi, *Hylaeus*, 114, 123, 290
douglasiellus, *Leioproctus*, 71, 259
doweri, *Lasioglossum*, 176
dowerinensis, *Trichocolletes*, 79
dromedarius, *Hylaeus*, 133
dubiosa, *Megachile*, 209
duboulaii, *Chalicodoma*, 201
Duckeola, 231

eboracense, *Lasioglossum*, 176
eboracina, *Nomia*, 160, 306
eboracina, *Palaeorhiza*, 146

eburneifera, *Nomia*, 154
eburniellus, *Hylaeus*, 127, 237
Echthralictus, 181
Edriohylaeus, 124, 324
edwardsii, *Euryglossa*, 94
Edwynia, 41
Edwyniana, 41
elegans, *Amegilla*, 216
elegans, *Chalicodoma*, 191
elegans, *Hylaeus*, 130, 237
elegans, *Leioproctus*, 63
elegans, *Nomia*, 154
elegans, *Palaeorhiza*, 146
elegans, *Stenotritus*, 83
elegantior, *Stenotritus*, 83
elegantissima, *Palaeorhiza*, 146
elliotti, *Nomia*, 154, 156
elliottii, *Lasioglossum*, 176
elongata, *Exoneura*, 225
elongata, *Nomia*, 159
elongata, *Trigona*, 230
elongatula, *Nomia*, 159
elongatus, *Hylaeus*, 123
elthamensis, *Hyphesma*, 105
emarginatus, *Thyreus*, 218
emendata, *Amegilla*, 216
emeraldense, *Lasioglossum*, 176
endeavouricola, *Euryglossa*, 87
enixa, *Palaeorhiza*, 146
ephippiata, *Euryglossa*, 94, 234
epiensis, *Homalictus*, 180
eraduensis, *Leioproctus*, 68
erimae, *Chalicodoma*, 204
erimae, *Nomia*, 156
ernesti, *Amegilla*, 216
erromanganus, *Homalictus*, 180
erythropyga, *Chalicodoma*, 197
erythrurum, *Lasioglossum*, 176, 239
erythrurus, *Trichocolletes*, 79
eschschoitziae, *Lasioglossum*, 173
essingtoni, *Trigona*, 230
etheridgei, *Lasioglossum*, 173
eucalypti, *Chalicodoma*, 197
eucalypti, *Leioproctus*, 50
eucalypti, *Meroglossa*, 150
eugeniarum, *Leioproctus*, 66
eugeniellus, *Hylaeus*, 123, 236
Euhesma, 88, 96, 98, 324
Eulonchopria, 40
Eumegachilana, 191, 324
Eumegachile, 206
Eunomioides, 183
eunota, *Xylocopa*, 228
Eupalaeorhiza, 145
euphenax, *Leioproctus*, 50
Euprosopellus, 132, 324, 338
Euprosopis, 122, 130
Euprosopoides, 131, 324

- eurhodopus*, *Homalictus*, 180
Euryapis, 228
Euryglossa, 87, 92
Euryglossella, 111
Euryglossidia, 66
Euryglossimorpha, 92
Euryglossina, 108, 109
Euryglossinae, 83
Euryglossula, 111, 324
euryurum, *Lasioglossum*, 176
Eutricharaea, 206
euxantha, *Euryglossa*, 96
euxanthus, *Hylaeus*, 129, 237
evansi, *Euryglossa*, 96, 277
evansum, *Lasioglossum*, 176
ewarti, *Lasioglossum*, 171
excavata, *Inquilina*, 226
excellens, *Nomia*, 156
exceptum, *Lasioglossum*, 176, 239
Excolletes, 56, 324
excultum, *Lasioglossum*, 167
excusum, *Lasioglossum*, 176
exima, *Palaeorhiza*, 146
exlautus, *Homalictus*, 180
Exoneura, 223, 226
Exoneurella, 224
exoneuroides, *Lasioglossum*, 171
expansifrons, *Lasioglossum*, 176
expulsum, *Lasioglossum*, 173
extensa, *Heterapoides*, 138
exterus, *Homalictus*, 180
extraordinarius, *Echthralictus*, 182
extrema, *Euryglossa*, 94
eyrei, *Homalictus*, 180, 241

fabricator, *Megachile*, 212
fabriciana, *Amegilla*, 216
faceta, *Chalicodoma*, 191
facetula, *Chalicodoma*, 191
facialis, *Leioproctus*, 50
fallax, *Leioproctus*, 55
familia, *Lasioglossum*, 176
familiaris, *Lasioglossum*, 171
fasciatella, *Euryglossa*, 91, 98
fasciatus, *Leioproctus*, 41
fastigata, *Ceratina*, 221
fausta, *Nomia*, 159
fazii, *Leioproctus*, 41
federalis, *Euryglossa*, 96, 278
ferox, *Chalicodoma*, 197
ferricauda, *Nomia*, 156, 239
ferricincta, *Megachile*, 210
ferricornis, *Stenotritus*, 83
ferrisi, *Amegilla*, 216
ferrisi, *Leioproctus*, 46
ferruginea, *Palaeorhiza*, 146
ferrugineus, *Leioproctus*, 41

fervida, *Creightonella*, 206
fervidus, *Leioproctus*, 50
fervidus, *Paracolletes*, 78
festivum, *Lasioglossum*, 176
festivus, *Leioproctus*, 50
fiebrigi, *Leioproctus*, 42
Fiji, 11, 16, 25
fijiensis, *Homalictus*, 180
fijiensis, *Hylaeus*, 134
filamentosus, *Leioproctus*, 70
filicis, *Euryglossa*, 91
Filiglossa, 69
fimbriata, *Trigona*, 231
fimbriatulus, *Leioproctus*, 66
fimbriatus, *Leioproctus*, 66
fimbriiventris, *Megachile*, 209
finkei, *Leioproctus*, 55, 248
finschi, *Chalicodoma*, 191
finschiana, *Xylocopa*, 228
flava, *Amegilla*, 218
flava, *Xanthosma*, 97, 281
flavicauda, *Euryglossa*, 96, 279
flavicauda, *Pachyprosopis*, 107
flaviceps, *Hylaeus*, 130
flavicornis, *Leioproctus*, 41
flavipennis, *Nomia*, 154, 156
flaviventris, *Euryglossina*, 109, 235
flaviventris, *Trigona*, 231
flavocinerea, *Xylocopa*, 228
flavocuneata, *Euryglossa*, 91
flavojugatus, *Hylaeus*, 123
flavolateralis, *Euryglossina*, 109, 235
flavomaculatus, *Leioproctus*, 50
flavomellea, *Palaeorhiza*, 146
flavopicta, *Euryglossa*, 96, 234
flavopunctatum, *Lasioglossum*, 167
flavorufus, *Leioproctus*, 71
flavoviridis, *Nomia*, 156, 239
flindersi, *Homalictus*, 180
florale, *Lasioglossum*, 176
floralis, *Nomia*, 159
florea, *Nomia*, 160
florentiae, *Exoneura*, 226
Flores, 18
Flower records, 233
Flower relationships, 21
foliata, *Megachile*, 210
formosa, *Nomia*, 154
formosulus, *Homalictus*, 180
formosus, *Homalictus*, 180
forresti, *Lasioglossum*, 167
forticorne, *Lasioglossum*, 176
fortior, *Nomia*, 156
fortis, *Lithurge*, 185
foveata, *Analastoroides*, 141
franki, *Chalicodoma*, 197
franki, *Lasioglossum*, 165

- franki*, *Leioproctus*, 41, 50
frankiellus, *Leioproctus*, 50
fraterna, *Creightonella*, 206
frederici, *Hylaeus*, 123, 236
frederici, *Paracolletes*, 78
Freiseomelitta, 231
frenchellum, *Lasioglossum*, 167
frenchi, *Lasioglossum*, 167
frenchi, *Leioproctus*, 50
frenchi, *Nomia*, 156
frenchii, *Euryglossa*, 94
frieseanus, *Thyreus*, 218
friesei, *Leioproctus*, 41, 50
Friesella, 230
friesellus, *Leioproctus*, 50
froggatti, *Amegilla*, 218
froggatti, *Coelioxys*, 212
froggatti, *Exoneura*, 225
froggatti, *Homalictus*, 180
froggatti, *Lasioglossum*, 167
froggatti, *Lithurge*, 185
froggatti, *Nomia*, 156
froggattiana, *Melittosmithia*, 99
frontalis, *Creightonella*, 206
frontalis, *Leioproctus*, 37
fruhstorferi, *Nomia*, 157
fuliginosa, *Nomia*, 160
fullawayi, *Megachile*, 209
fultoni, *Chalicodoma*, 197
fultoni, *Euryglossula*, 85, 105, 112
fultoni, *Exoneura*, 226
fultoni, *Lasioglossum*, 168
fulva, *Palaeorhiza*, 146
fulvata, *Nomia*, 154
fulvescens, *Leioproctus*, 53
fulvescens, *Pachyprosopis*, 107
fulvicornis, *Callomelitta*, 39
fulvicornis, *Hylaeus*, 132
fulvifrons, *Megachile*, 209
fulvinerva, *Nomia*, 159
fulvipennis, *Chalicodoma*, 191
fulviventre, *Lasioglossum*, 168
fulviventris, *Nomia*, 160
fulvoanalis, *Nomia*, 156
fulvofasciae, *Lasioglossum*, 165, 239, 310
fulvomarginata, *Chalicodoma*, 197
fulvus, *Leioproctus*, 63
fumidicauda, *Lasioglossum*, 168
fumipennis, *Chalicodoma*, 197
funeraria, *Chalicodoma*, 191
funnelli, *Chalicodoma*, 204
furcifera, *Brachyhesma*, 288
furcifera, *Xanthesma*, 97
furneauxi, *Lasioglossum*, 176
fusca, *Megachile*, 186
fuscescens, *Euryglossina*, 109
fuscipennis, *Creightonella*, 206
fuscitarsis, *Megachile*, 212
fusciventris, *Euryglossina*, 109, 235
gabonica, *Xylocopa*, 228
gacellae, *Palaeorhiza*, 146
gahani, *Megachile*, 209
gallipes, *Leioproctus*, 66
Gastropsis, 82
gazellae, *Nomia*, 157
geminata, *Euryglossa*, 96
gemmatus, *Thyreus*, 219
genalis, *Trigona*, 231
generosa, *Nomia*, 156
Geniotrigona, 231
gentianae, *Lasioglossum*, 168
geophila, *Nomia*, 156
georgica, *Pachyprosopis*, 106
Geotrigona, 231
Gephyrohylaeus, 138, 324
gibba, *Sphecodes*, 182
gibbonsi, *Hylaeus*, 130
gibbonsi, *Lestis*, 228
gibbosum, *Lasioglossum*, 168
gigantea, *Chalicodoma*, 192
giganteus, *Hylaeus*, 134
gilberti, *Amegilla*, 216
gilberti, *Euryglossina*, 109
gilberti, *Nomia*, 156
gilbertiella, *Chalicodoma*, 197, 321
gilesi, *Lasioglossum*, 176
gippsii, *Lasioglossum*, 176
glaberrima, *Megachile*, 209
glauerti, *Ctenocolletes*, 83
glauerti, *Euryglossina*, 109
glauerti, *Lasioglossum*, 176
globosum, *Lasioglossum*, 176
globulare, *Lasioglossum*, 173
globuliceps, *Euryglossina*, 109, 235
globuliferus, *Hylaeus*, 129
Glossalictus, 173, 324
Glossurocolletes, 60, 324
Gnathocera, 206
Gnathodon, 187
Gnathoprosopis, 127
Gnathoprosopoides, 122, 127, 324
godeffroyi, *Chalicodoma*, 192
Goniocolletes, 64
goodeniae, *Euryglossa*, 91
goraeense, *Lasioglossum*, 176
goraeensis, *Leioproctus*, 54
gosfordensis, *Hylaeus*, 130
gracilicaudis, *Hylaeus*, 130
gracilipes, *Nomia*, 156
gracilis, *Exoneura*, 225, 242
grande, *Lasioglossum*, 168
grandis, *Chalicodoma*, 197
grandis, *Exoneura*, 226

- grandis*, *Prosopis*, 117
granulihorax, *Lasioglossum*, 176
gratiosa, *Palaeorhiza*, 146
grayella, *Amegilla*, 216
greavesi, *Hylaeus*, 123
greavesi, *Stenotritus*, 83
greavesi, *Lasioglossum*, 176
gressitti, *Nomia*, 161, 307
gressitti, *Xylocopa*, 228
grisea, *Allodape*, 87
grisea, *Allodapula*, 223
griseipenne, *Lasioglossum*, 168
grisella, *Nomia*, 156
griseovittatum, *Lasioglossum*, 176, 240
griscens, *Amegilla*, 218
Gronoceras, 187
guigliae, *Xylocopa*, 229
gunbowernse, *Lasioglossum*, 176
gynochilum, *Lasioglossum*, 176, 240, 314
- hackeri*, *Amegilla*, 216
hackeri, *Chalicodoma*, 198
hackeri, *Exoneura*, 226, 243
hackeri, *Hylaeus*, 129, 237
hackeri, *Leioproctus*, 50, 54
hackeri, *Pachyprosopis*, 106
hackeri, *Trichocolletes*, 79, 234
Hackeriapis, 193
hackeriella, *Heterapoides*, 138, 238
hackeriellus, *Homalictus*, 180
haematogastra, *Megachile*, 209
haematopodus, *Hylaeus*, 126
haematoptera, *Trigona*, 231
haematopus, *Lasioglossum*, 176, 240
haematostoma, *Lasioglossum*, 176
haematostoma, *Pachyprosopis*, 106, 235
haematura, *Euryglossa*, 94
haemorrhoidalis, *Nomia*, 156
Halictanilhrena, 42
halictella, *Nomia*, 159, 239
Halictidae, 151
halictiformis, *Heterapoides*, 138
halictiformis, *Leioproctus*, 55, 69
halictina, *Euryglossa*, 91
Halictinae, 161
halictoides, *Euryglossa*, 91
halictoides, *Lasioglossum*, 174
halictomimus, *Leioproctus*, 55
Halictus, 162, 163
hamada, *Palaeorhiza*, 147
hampsoni, *Megachile*, 209
hamulata, *Exoneura*, 226, 243
hardcastlei, *Amphylaeus*, 149
hardyi, *Chalicodoma*, 198
hardyi, *Leioproctus*, 51
hedleyi, *Homalictus*, 180
hedleyi, *Megachile*, 209
hedleyi, *Palaeorhiza*, 146
- heideri*, *Trigona*, 231
helichrysi, *Lasioglossum*, 176
helichrysi, *Leioproctus*, 55, 233
heliophila, *Chalicodoma*, 198
helmsi, *Leioproctus*, 51
hemichalceum, *Lasioglossum*, 176
hemichlora, *Euryglossa*, 91
Hemirhiza, 147, 324
hemirhodus, *Hylaeus*, 127, 294
hemixantha, *Euryglossa*, 85, 91
heriadiformis, *Chalicodoma*, 198
henrici, *Chalicodoma*, 198
hentyi, *Homalictus*, 180
herbsti, *Leioproctus*, 41
heronii, *Leioproctus*, 54
hertlei, *Chalicodoma*, 191
hertlei, *Xylocopa*, 229
Hesperocolletes, 75, 324
hessei, *Anthidiellum*, 213
Heterapis, 137
Heterapoides, 137
Heterocolletes, 47
heterodoxus, *Leioproctus*, 70
Heterohesma, 91, 97, 324
Heterorhiza, 146
Heterotrigona, 231
Hexanthes, 40
hieroglyphica, *Hemirhiza*, 147
hieroglyphica, *Ceratina*, 221
hilactum, *Lasioglossum*, 168
hilara, *Palaeorhiza*, 146
hilli, *Homalictus*, 180
hilli, *Megachile*, 210
hilli, *Meroglossa*, 150
hillieri, *Leioproctus*, 66
hillii, *Hylaeus*, 130
hippophila, *Nomia*, 156
hirtipes, *Leioproctus*, 53
hirtiventre, *Lasioglossum*, 168, 239
 History of the fauna, 19
histrion, *Holohesma*, 102
hobartensis, *Leioproctus*, 51
hobartianus, *Hylaeus*, 123
hobartiellus, *Hylaeus*, 123
hockingsi, *Trigona*, 231
Holcomegachile, 206
Holmbergia, 41
holmesi, *Amegilla*, 216
holmesi, *Exoneura*, 226
holochlorus, *Homalictus*, 180
Holohesma, 102, 324
holoxanthopus, *Pachyprosopis*, 106
holura, *Chalicodoma*, 198
Homalictus, 177, 338
Homotrigona, 231
honestus, *Hylaeus*, 130
Hoplocolletes, 41, 42, 324
Hoplonomia, 154

- horatii*, *Chalicodoma*, 198
hortorum, *Bombus*, 229
horvathi, *Nomia*, 161
huberi, *Trigona*, 231
hudsoni, *Hylaeus*, 123
hudsoni, *Leioproctus*, 51
humei, *Lasioglossum*, 176
humeralis, *Pachyprosopis*, 107, 235
humeralis, *Palaeorhiza*, 146
humerosus, *Leioproctus*, 51
humiliiformis, *Homalictus*, 180
humilis, *Homalictus*, 180
huseloides, *Hylaeus*, 130
huselus, *Hylaeus*, 130
huttoni, *Lasioglossum*, 171
hybodinum, *Lasioglossum*, 168
Hylaeinae, 114
Hylaeorhiza, 141, 324
Hylaeteron, 126, 324
Hylaeus, 117, 135, 338
Hyleoides, 151
Hypthesma, 91, 103, 324
hypthesmoides, *Euryglossa*, 86, 91, 105, 234, 269
hypochroma, *Euryglossina*, 109, 235
hypodonta, *Nomia*, 156
hypoleucus, *Hylaeus*, 136
hypoxantha, *Brachyhesma*, 114, 287

ibanezii, *Leioproctus*, 41
ibex, *Leioproctus*, 51
ichneumonoides, *Leioproctus*, 69
idalia, *Megalopta*, 159
idoneum, *Lasioglossum*, 176, 240
ignescens, *Megachile*, 209
ignita, *Chalicodoma*, 198
iheringi, *Leioproctus*, 41
illawarraensis, *Leioproctus*, 51
illustris, *Exoneura*, 226
imitans, *Lasioglossum*, 176
imitata, *Amegilla*, 218
imitata, *Megachile*, 209
imitator, *Lasioglossum*, 170, 239, 313
imitator, *Leioproctus*, 69
imitatus, *Leioproctus*, 51
impatellatus, *Leioproctus*, 58, 251
imperialis, *Palaeorhiza*, 146
impressifrons, *Meroglossa*, 150, 238
inca, *Leioproctus*, 41
incanescens, *Leioproctus*, 55, 233
incerta, *Exoneura*, 226
incerta, *Nomia*, 156
incisa, *Chalicodoma*, 191
inclinans, *Lasioglossum*, 176
incompleta, *Brachyhesma*, 114, 236, 288
incomptus, *Leioproctus*, 51
inconspicua, *Euryglossa*, 91
indecisus, *Hylaeus*, 126
indicans, *Pachyprosopis*, 106

indicator, *Prosopis*, 117
indigoteus, *Homalictus*, 180
Indohalictus, 178
infans, *Hylaeus*, 123
infimum, *Lasioglossum*, 176
inflaticauda, *Chalicodoma*, 204
infrahirtum, *Lasioglossum*, 176
infusata, *Palaeorhiza*, 146, 302
ingens, *Chalicodoma*, 192
innocens, *Hylaeus*, 123
Inquilina, 226
inquirendus, *Leioproctus*, 42
insculptum, *Lasioglossum*, 165, 239
insigne, *Lasioglossum*, 168
insignis, *Neopasiphae*, 75
instabilis, *Lasioglossum*, 176
insulare, *Lasioglossum*, 173
insularis, *Callomelitta*, 39
insularis, *Exoneura*, 226
insularis, *Leioproctus*, 51, 233
insularis, *Megachile*, 209
insularis, *Nomada*, 214
intermedia, *Euryglossina*, 109, 235, 285
intermedius, *Lasioglossum*, 176
interrupta, *Ceratina*, 221
intrudens, *Coelioxys*, 212
iridescens, *Nomia*, 154
iridipennis, *Trigona*, 231
irroratus, *Leioproctus*, 51
isthmale, *Lasioglossum*, 176
itama, *Trigona*, 231
itamuca, *Meroglossa*, 150

jamesi, *Amegilla*, 216
jaty, *Trigona*, 231
Java, 11, 17, 18
javana, *Apis*, 232
javanicum, *Anthidiellum*, 213
jenseni, *Leioproctus*, 41
joergenseni, *Leioproctus*, 41
jucunda, *Euryglossa*, 94
jugatus, *Hylaeus*, 132
jutefae, *Palaeorhiza*, 146

kalamundae, *Hylaeus*, 132
kalutarae, *Lasioglossum*, 173
kalutarae, *Pachyhalictus*, 338
kangrae, *Nomia*, 159
kankauana, *Nomia*, 157
karnyi, *Xylocopa*, 229
kellyi, *Pachyprosopis*, 107
kelvini, *Hylaeus*, 137, 238
kershawi, *Meroglossa*, 150
kestevensi, *Homalictus*, 180
Key to the families, 33
keyensis, *Trigona*, 231
kirbiella, *Chalicodoma*, 203
kirbyana, *Chalicodoma*, 203

- kochi*, *Nomia*, 161
Koptogaster, 120
Koptorthosoma, 228
Koptortosoma, 228
kuehni, *Chalicodoma*, 191, 320
kurandense, *Lasioglossum*, 165
kurandensis, *Megachile*, 209
kurandensis, *Palaeorhiza*, 146
kurandina, *Nomia*, 156
kuschei, *Megachile*, 209

labascens, *Megachile*, 210
labiatus, *Hylaeus*, 130
laboriosa, *Chalicodoma*, 191
lachesis, *Creightonella*, 206
lactium, *Lasioglossum*, 168
lacteipennis, *Euryglossa*, 96, 276
lactiferus, *Pharohylaeus*, 141
laeta, *Exoneura*, 226
laeviceps, *Trigona*, 231
laevigata, *Hylaeus*, 123
laevigatulus, *Hylaeus*, 123
laevigatum, *Stilpnosoma*, 101
lahorensis, *Lasioglossum*, 173
lamingtonia, *Trigona*, 231
Lamprocolletes, 47, 48
lamprosomus, *Thyreus*, 219
lanariellum, *Lasioglossum*, 176
lanarium, *Lasioglossum*, 176, 240
languinosum, *Lasioglossum*, 176, 240
lanhami, *Leioproctus*, 51, 245
Lasioglossum, 162, 171, 338
lateralis, *Euryglossa*, 94
lateralis, *Hylaeus*, 126
latericauda, *Chalicodoma*, 198
lateritia, *Chalicodoma*, 191
latetibialis, *Nomia*, 156
laticeps, *Leioproctus*, 42
latifrons, *Trichocolletes*, 80
latipes, *Chalicodoma*, 198
latipes, *Xylocopa*, 228
latissima, *Euryglossa*, 91
latissimum, *Lasioglossum*, 168
latitarsis, *Homalictus*, 180
latitarsis, *Nomia*, 156
latiuscula, *Nomia*, 156
latro, *Echthralictus*, 182
launcestonensis, *Leioproctus*, 51
lautula, *Nomia*, 159
lautulum, *Anthidiellum*, 213
lavoroensis, *Homalictus*, 180
lawsoni, *Exoneura*, 224
leai, *Hylaeus*, 123
leai, *Lasioglossum*, 176, 240
leai, *Leioproctus*, 51
leana, *Leioproctus*, 42
leeuwiniensis, *Chalicodoma*, 198
leichardti, *Lasioglossum*, 168, 239

Leioproctus, 39, 47
lendliana, *Trigona*, 230
lepidota, *Nomia*, 157
Leptoglossa, 42
Leptorachis, 206
leptospermi, *Euryglossa*, 94
leptospermi, *Hylaeus*, 130
leptospermi, *Lasioglossum*, 168
leptospermi, *Paracolletes*, 78
Lestis, 227
leucopogon, *Megachile*, 209
leucopyga, *Chalicodoma*, 198
leucorhinum, *Lasioglossum*, 168
leucosphaerus, *Hylaeus*, 130
leucostomus, *Leioproctus*, 41
leucurus, *Homalictus*, 180
levicauda, *Nomia*, 159
levigata, *Hylaeus*, 123
lichatinum, *Lasioglossum*, 168
lichatum, *Lasioglossum*, 168
lilacine, *Amegilla*, 216
limatiformis, *Homalictus*, 180, 241
limatus, *Homalictus*, 180
lineatipes, *Megachile*, 209
liogonius, *Prosopis*, 117
Liothyrapis, 212
Literature cited, 325
Lithurge, 184
Lithurginae, 184
Lithurgus, 184
lithuscum, *Lasioglossum*, 168
Liomegachile, 206
littleri, *Callomelitta*, 39
littleri, *Hylaeus*, 123
littleri, *Lasioglossum*, 176
littoralis, *Homalictus*, 180
lomatiae, *Homalictus*, 180
Lonchopria, 41
longiceps, *Chalicodoma*, 198
longiceps, *Palaeorhiza*, 146
longicornis, *Euryglossa*, 94
longicornis, *Nomia*, 161
longipes, *Leioproctus*, 41
longitarsis, *Nomia*, 154
longmani, *Amegilla*, 217
longmani, *Amphylaeus*, 148
longmani, *Lasioglossum*, 168
longula, *Amegilla*, 217
Lophotrigona, 231
Lord Howe Island, 16
lorentzi, *Chalicodoma*, 191
lorentzi, *Homalictus*, 180
loweri, *Lasioglossum*, 168
lubbocki, *Hylaeus*, 132
lucidiventris, *Chalicodoma*, 198
lucidula, *Ceratina*, 220
lucidulus, *Leioproctus*, 41
lucidus, *Trichocolletes*, 80

- luctificum*, *Lasioglossum*, 176
lugubris, *Thyreus*, 219
lundqvisti, *Xylocopa*, 229
lusoria, *Nomia*, 154
lusoria, *Palaeorhiza*, 146
lutea, *Euryglossa*, 91
luteiceps, *Chalicodoma*, 191
luteipes, *Homalictus*, 180
luteipes, *Leioproctus*, 41
luteiventris, *Nomia*, 161
luteoaeus, *Homalictus*, 180
luteofasciata, *Nomia*, 154
luteola, *Amegilla*, 217
luxuriosa, *Palaeorhiza*, 146
lynettae, *Euryglossina*, 109
lyonsiae, *Nomia*, 156
Lysicolletes, 66

maai, *Nomia*, 156, 304
mackayense, *Lasioglossum*, 176
mackayensis, *Chalicodoma*, 198
mackayensis, *Hylaeus*, 123
mackieae, *Homalictus*, 180
macleayi, *Chalicodoma*, 198
macleayi, *Thyreus*, 219
macrodonatus, *Leioproctus*, 63
Macrohyla, 133, 324
macrops, *Lasioglossum*, 176
macrostoma, *Euryglossina*, 109, 235
maculariformis, *Megachile*, 209
macularis, *Megachile*, 209, 242
macularis, *Nomia*, 156
maculata, *Euryglossa*, 91, 96
maculata, *Exoneura*, 225
maculata, *Megachile*, 209
maculatus, *Hylaeus*, 129, 130
maculatus, *Leioproctus*, 51
maculiceps, *Hylaeus*, 130
maculifera, *Euryglossa*, 91
maculipennis, *Hylaeus*, 124
Maiella, 228
maiellus, *Hylaeus*, 126, 236
mailandi, *Homalictus*, 180, 338
maiusculum, *Lasioglossum*, 176
major, *Hylaeus*, 132
malachisis, *Palaeorhiza*, 146
malaris, *Euryglossa*, 91, 270
malayana, *Chalicodoma*, 191
malpighiacearum, *Leioproctus*, 42
maluae, *Palaeorhiza*, 146
mandibularis, *Palaeorhiza*, 147, 303
manskii, *Sphex*, 182
maorianus, *Hylaeus*, 123
maorium, *Leioproctus*, 51
marginata, *Leioproctus*, 41
marginatulus, *Trichocolletes*, 80, 234, 264
marginatus, *Trichocolletes*, 80
marionellus, *Hylaeus*, 123

maritimus, *Leioproctus*, 51
marjoriella, *Exoneura*, 224
mas, *Leioproctus*, 70, 258
matheranense, *Lasioglossum*, 173
masteri, *Leioproctus*, 69
maura, *Euryglossa*, 91
Maximegachile, 187
maximus, *Trichocolletes*, 80
mcnamarae, *Amegilla*, 217
mcnamerae, *Chalicodoma*, 191
medionigrum, *Anthidiellum*, 213
mediopolitum, *Lasioglossum*, 176
mediorufa, *Nomia*, 159
mediostictus, *Amphylaeus*, 148, 238
mediovirens, *Hylaeus*, 123
megachalceus, *Leioproctus*, 63
megachalcoides, *Leioproctus*, 51, 246
Megachile, 206
Megachilidae, 184
Megachilinae, 185
Megachilini, 185
Megachiloides, 206
megadonatus, *Leioproctus*, 63
Megalopta, 159
Megaloptodes, 159
Megapis, 231
megasoma, *Nomia*, 154
megastigmus, *Homalictus*, 180
Meghyla, 133
megista, *Creightonella*, 206
melaena, *Exoneura*, 226
melaleuca, *Hylaeus*, 117
melanaspis, *Anthidiellum*, 213
melanocephalus, *Hylaeus*, 126
melanodonta, *Nomia*, 156
melanoproctus, *Leioproctus*, 51
melanops, *Hylaeus*, 123, 236
melanoptera, *Nomia*, 156
melanopterum, *Lasioglossum*, 177
Melanosarus, 206
melanosoma, *Euryglossa*, 91
melanothorax, *Euryglossa*, 96
melanura, *Palaeorhiza*, 146
melanurum, *Lasioglossum*, 171
melanurus, *Leioproctus*, 41, 51
melbournense, *Lasioglossum*, 168
melbournensis, *Leioproctus*, 51
Melectini, 218
Meliponini, 230
Melitribus, 82
Melittidae, 183, 338
Melittosmithia, 98
mellea, *Euryglossina*, 111, 236
melliceps, *Hemirhiza*, 147, 238
mellifera, *Apis*, 231, 232
mellifica, *Apis*, 231
mellipes, *Trigona*, 231
Mellitidia, 160

- meltonensis*, *Amegilla*, 218
melvilliana, *Nomia*, 156
mendanae, *Chalicodoma*, 191
merescens, *Lasioglossum*, 171
meriti, *Hylaeus*, 126
Meroglossa, 149
Meroglossula, 149
mertoni, *Megachile*, 187
mesembryanthemi, *Lasioglossum*, 177
mesembryanthemiellum, *Lasioglossum*, 177
mesocyaneus, *Homalictus*, 180, 181
metallensens, *Leioproctus*, 51
metallica, *Nomia*, 157, 161
metallicus, *Hylaeus*, 132
metallicus, *Leioproctus*, 51
Methods, 25
mewiella, *Amegilla*, 217
mica, *Euryglossa*, 91
Micrapis, 231
micrerythrura, *Chalicodoma*, 198
micridoneum, *Lasioglossum*, 177
microchalceus, *Homalictus*, 180
Microcolletes, 48, 55, 324
microdonta, *Euryglossula*, 112
microdontum, *Lasioglossum*, 168
Microdontrua, 111
microdontus, *Leioproctus*, 66
Microglossa, 108
Microglossella, 109
Microhesma, 113, 324
microphenax, *Hylaeus*, 123, 289
microsomus, *Leioproctus*, 55, 233, 248
microxantha, *Brachyhesma*, 114
millariellus, *Hylaeus*, 129
milleri, *Lasioglossum*, 177
mimica, *Amegilla*, 217
mimosae, *Nomia*, 154
mimulus, *Leioproctus*, 51
mimus, *Leioproctus*, 73
minikoienae, *Lasioglossum*, 173
minima, *Euryglossina*, 111
minimus, *Leioproctus*, 70, 258
minimus, *Parasphcodes*, 162
minor, *Allodapula*, 223
minor, *Leioproctus*, 51
minusculeus, *Hylaeus*, 124
minuta, *Euryglossina*, 109
minutissima, *Exoneura*, 226
minutissimum, *Anthidiellum*, 213
minutula, *Megachile*, 209
minutula, *Nomia*, 159
minutus, *Leioproctus*, 55
mirabilis, *Neopasiphae*, 75
mirabilis, *Pachyprosopis*, 106, 235
miranda, *Nomia*, 157
mirandum, *Lasioglossum*, 177
mirandus, *Hylaeus*, 136
Mitchellapis, 211, 324
mitchelli, *Lasioglossum*, 177
mitimia, *Creightonella*, 204
mjobergi, *Lasioglossum*, 177
mocsaryi, *Thyreus*, 219
modesta, *Chalicodoma*, 198
modesta, *Nomia*, 159
moera, *Chalicodoma*, 204
moerens, *Leioproctus*, 41
moerens, *Nomia*, 157
mohnikei, *Xylocopa*, 229
Moluccas, 17, 18, 25
mombuca, *Trigona*, 231
moniliformis, *Leioproctus*, 51
monkmani, *Chalicodoma*, 198
monstrosa, *Chalicodoma*, 199
montana, *Exoneura*, 226
montanus, *Paracolletes*, 78
monticola, *Leioproctus*, 53
morata, *Nomia*, 159
moreense, *Lasioglossum*, 177
moretonianus, *Leioproctus*, 40, 73, 233
morosus, *Amphylaeus*, 149
morotaiana, *Xylocopa*, 229
Morphological terms, 27
morsus, *Leioproctus*, 66
mortyana, *Chalicodoma*, 191
mosquito, *Trigona*, 230
Mourella, 230
muiri, *Palaeorhiza*, 146
muiri, *Xylocopa*, 229
multigibbosus, *Hylaeus*, 136, 238, 296
mundifica, *Chalicodoma*, 198
mundulum, *Lasioglossum*, 177
muraria, *Chalicodoma*, 187
murrayensis, *Amegilla*, 217
murrayensis, *Ctenocolletes*, 83
murrayensis, *Euryglossa*, 94
murrayensis, *Hylaeus*, 123
murrayi, *Amegilla*, 217
murrayi, *Homalictus*, 180
muscaria, *Xylocopa*, 227, 229
muscosa, *Nomia*, 157
musgravei, *Hylaeus*, 130
musgravei, *Lasioglossum*, 170
musgravei, *Nomia*, 157
musicum, *Lasioglossum*, 168, 239
mutica, *Euryglossina*, 109
myrtacearum, *Euryglossa*, 94
mystacea, *Megachile*, 210, 242
mystaceana, *Chalicodoma*, 191, 241
nana, *Chalicodoma*, 204
nana, *Euryglossina*, 109
nana, *Nomia*, 157
nanus, *Hylaeus*, 123
nanus, *Leioproctus*, 51
nanus, *Thyreus*, 219
narifera, *Euryglossina*, 85, 105, 109

- nasicense*, *Lasioglossum*, 173
nasuta, *Chalicodoma*, 198
neglectula, *Euryglossa*, 91, 234
nematocera, *Chalicodoma*, 204
Neoceratina, 220
Neomegachile, 206
Neopasiphae, 73
neotropicus, *Leioproctus*, 41
Nesocolletes, 52, 324
Nesohalictus, 173
Nesoprosopis, 117
Nesting, 8, 9, 35, 38, 42, 87, 109, 118, 142, 148, 150, 151, 152, 161, 187, 205, 216, 217, 220, 222, 223, 226, 228, 229, 294, 320
New Caledonia, 11, 18, 25
New Guinea, 11, 15, 17, 18, 25
New Hebrides, 11, 18
New Zealand, 11, 16, 25
nicholsoni, *Ctenocolletes*, 83
nicholsoni, *Leioproctus*, 51
nidulator, *Chalicodoma*, 191
nigerrimus, *Lithurge*, 185
nigra, *Callomelitta*, 39
nigra, *Euryglossa*, 91, 94
nigrescens, *Exoneura*, 224
nigrescens, *Hylaeus*, 123
nigrescens, *Leioproctus*, 69
nigrescens, *Nomada*, 214
nigrescens, *Stenotritus*, 83
nigrescens, *Thyreus*, 219
nigrifrons, *Leioproctus*, 71, 260
nigrifrons, *Meroglossa*, 150, 238
nigrihirta, *Exoneura*, 226
nigrior, *Leioproctus*, 59
nigrior, *Xanthisma*, 97, 282
nigritarsus, *Hylaeus*, 129
nigritulus, *Leioproctus*, 51
nigritus, *Parasphecodes*, 162
nigriventris, *Callomelitta*, 39, 51
nigrocaerulea, *Euryglossa*, 94
nigrocinctus, *Paracolletes*, 78
nigroclypeata, *Xylocopa*, 229
nigroclypeatus, *Leioproctus*, 51
nigroclypeatus, *Trichocolletes*, 80
nigrocyanea, *Euryglossa*, 87
nigrofasciata, *Callomelitta*, 39
nigrofulva, *Exoneura*, 226
nigrofulvus, *Leioproctus*, 51
nigrohirta, *Megachile*, 210
nigropersonatus, *Hylaeus*, 132
nigroplagiata, *Xylocopa*, 229
nigropolitum, *Lasioglossum*, 177
nigropurpureum, *Lasioglossum*, 177
nigropurpureus, *Leioproctus*, 51
nigroscopaceum, *Lasioglossum*, 165
nigrovittata, *Chalicodoma*, 198
nitida, *Allocaula*, 223
nitida, *Exoneura*, 226
nitidiceps, *Hyphesma*, 105
nitidifrons, *Euryglossa*, 91
nitidior, *Leioproctus*, 41
nitidiscutata, *Chalicodoma*, 191
nitidulus, *Leioproctus*, 51
nitidulus, *Thyreus*, 219
nitidus, *Stenotritus*, 83
niveatum, *Lasioglossum*, 168
niveicollis, *Palaeorhiza*, 146
niveifrons, *Homalictus*, 180
niveorufum, *Lasioglossum*, 168
nivosus, *Leioproctus*, 41
noachinum, *Lasioglossum*, 168
nobilis, *Xylocopa*, 229
Nodocolletes, 48, 61
nodosicornis, *Hylaeus*, 130
Nomada, 214
nomadiformis, *Leioproctus*, 51
nomadiformis, *Stenohesma*, 100, 283
Nomadinae, 214
Nomia, 152, 154
nomiaeformis, *Leioproctus*, 55
Nomiapis, 157
Nomiinae, 152
Nomiocolletes, 41
Nomioides, 183
normani, *Exoneura*, 226
notabilis, *Ctenocolletes*, 83, 266
notabilis, *Nomia*, 159
notescens, *Lasioglossum*, 168
nothula, *Euryglossina*, 109, 235
Notocolletes, 70
novaeahollandiae, *Thyreus*, 219
nubifera, *Euryglossa*, 91
nubilipennis, *Euryglossa*, 94
nubilosa, *Hylaeorhiza*, 142, 238
nubilosellus, *Amphylaeus*, 148, 238
nuda, *Chalicodoma*, 198
nuda, *Nomia*, 156, 157
nudum, *Lasioglossum*, 177
obesa, *Pachyprosopis*, 106, 235
obliqua, *Nomioides*, 183
obliterata, *Exoneura*, 226, 243
oblitum, *Lasioglossum*, 177
oblonga, *Chalicodoma*, 198
obscura, *Euryglossa*, 94, 234
obscura, *Exoneura*, 226
obscuriceps, *Prosopis*, 117
obscuripennis, *Leioproctus*, 51
obscuripes, *Exoneura*, 226
obscuripes, *Lasioglossum*, 177
obscurissimum, *Lasioglossum*, 177, 240, 315
obscurus, *Leioproctus*, 51
obtusa, *Megachile*, 209
obtusatus, *Hylaeus*, 132, 237
occidentalis, *Allocaula*, 223
occidentalis, *Exoneura*, 226

- occidentalis*, *Homalictus*, 179
occidentalis, *Hylaeus*, 130
occipitalis, *Euryglossa*, 94
ocellata, *Meroglossa*, 150, 304
ocellifera, *Chalicodoma*, 204
oculiformis, *Chalicodoma*, 198
oculipes, *Chalicodoma*, 198
Odontotrigona, 231
odynroides, *Lasioglossum*, 165
Oestropsis, 82
ofarrelli, *Hylaeus*, 124, 236, 293
oleariae, *Hyphesma*, 105
olgae, *Lasioglossum*, 168
Olagotropus, 187
olivinus, *Homalictus*, 180
omissus, *Thyreus*, 219
omnivagum, *Lasioglossum*, 177
opacicolle, *Lasioglossum*, 177
opacior, *Leioproctus*, 53
opaculus, *Leioproctus*, 51
oppidalis, *Chalicodoma*, 193
opposita, *Chalicodoma*, 191
optima, *Palaeorhiza*, 146
opulenta, *Nomia*, 154
oqualiensis, *Palaeorhiza*, 146
orbatum, *Lasioglossum*, 177, 240
Orbitella, 228
ordensis, *Ctenocolletes*, 83, 267
ordinaria, *Chalicodoma*, 198
orientalis, *Leioproctus*, 42
ornata, *Trigona*, 230
ornatissimus, *Leioproctus*, 51, 233
ornatula, *Euryglossa*, 96
ornatum, *Lasioglossum*, 177
Orphana, 42
osea, *Chalicodoma*, 191
oithona, *Megachile*, 210
ounuensis, *Homalictus*, 180
oxleyi, *Euryglossa*, 94
oxoniellus, *Homalictus*, 180, 241

pachycephala, *Euryglossina*, 111
pachycephalum, *Lasioglossum*, 177
pachygnathus, *Hylaeus*, 132
Pachyhalictus, 171, 338
Pachyodont, 37
pachyodontus, *Leioproctus*, 59
Pachyprosopina, 108, 324
Pachyprosopsis, 105, 106
Pachyprosopula, 106, 324
pacificus, *Leioproctus*, 63, 255
Palaeorhiza, 142, 145
palauensis, *Homalictus*, 181
palavanica, *Nomia*, 159
pallidicinctus, *Leioproctus*, 51
pallidifrons, *Homalictus*, 180
pallidus, *Leioproctus*, 66
palpalis, *Euryglossa*, 91, 271

palpalis, *Leioproctus*, 41
papuae, *Chalicodoma*, 198, 322
papuana, *Ceratina*, 221
papuana, *Megachile*, 209
papuana, *Nomada*, 214
papuana, *Nomia*, 156
papuana, *Palaeorhiza*, 146
papuanus, *Leioproctus*, 51
papuarum, *Homalictus*, 180
paracallida, *Chalicodoma*, 198
Paracolletes, 76
Paracolletini, 36
paracolletinum, *Lasioglossum*, 168
paradoxus, *Leioproctus*, 42
paraguayensis, *Leioproctus*, 42
Parahesma, 92, 324
parallela, *Palaeorhiza*, 146
Paramegachile, 206
paramelaenum, *Lasioglossum*, 168
Paranomina, 153
Paranomina, 153
parapulchra, *Amegilla*, 217
pararhodura, *Chalicodoma*, 198
Parasphcodes, 165
paratasmanica, *Chalicodoma*, 198
parazantha, *Euryglossula*, 112
Parevaspis, 213
parvula, *Chalicodoma*, 204
parvula, *Exoneura*, 226
parvula, *Nomia*, 156
parvula, *Xylocopa*, 229
parvus, *Leioproctus*, 42
Pasiphae, 41
patellifera, *Nomia*, 159
patongense, *Lasioglossum*, 168
patricia, *Palaeorhiza*, 146
paupercula, *Pachyprosopsis*, 108
pavonellus, *Homalictus*, 180
pavonellus, *Leioproctus*, 51
pavonura, *Euryglossa*, 94
Pectinata, 135
penangensis, *Nomia*, 154
penetrata, *Meroglossa*, 150, 238
pennata, *Nomia*, 157
perasserta, *Amegilla*, 217
peraustrale, *Lasioglossum*, 165, 239
percallomelittinus, *Parasphcodes*, 162
percincta, *Trigona*, 230
percingulatum, *Lasioglossum*, 177
perconstrictus, *Hylaeus*, 133
perconvergens, *Hylaeus*, 132, 295
percrassa, *Meroglossa*, 150
perditella, *Nomioides*, 183, 241
perditiformis, *Euryglossa*, 91
Perditomorpha, 41
peregrinata, *Coelioxys*, 212
perfasciatus, *Leioproctus*, 66
perforator, *Xylocopa*, 228

- pergibbosus*, *Hylaeus*, 133
perhumile, *Lasioglossum*, 173
perhumilis, *Hylaeus*, 123, 236
perkinsi, *Euryglossa*, 91, 234, 272
perkinsi, *Euryglossina*, 111, 236, 287
perkinsi, *Palaeorhiza*, 146
perkinsi, *Xylocopa*, 229
perkinsiella, *Allodapula*, 223
perlucida, *Nomia*, 157
perlutea, *Brachyhesma*, 114
permetallicum, *Lasioglossum*, 168, 312
perminutus, *Leioproctus*, 55
permiranda, *Palaeorhiza*, 146
pernana, *Euryglossa*, 91
perparvula, *Exoneura*, 226
perpensa, *Exoneura*, 226
perpessicius, *Homalictus*, 180
perpicta, *Callomelitta*, 39
perpictus, *Hylaeus*, 123
perplexa, *Exoneura*, 226
perplexus, *Hylaeus*, 132
perpolitus, *Leioproctus*, 55
perpulchra, *Amegilla*, 217
perpulchra, *Euryglossa*, 96
perpusilla, *Euryglossina*, 109
perrufus, *Hylaeus*, 126
personata, *Euryglossina*, 109, 235
personatus, *Leioproctus*, 42
persooniae, *Leioproctus*, 55
persulcata, *Meroglossa*, 151
pertasmaniae, *Lasioglossum*, 171
pertribuarium, *Lasioglossum*, 171
perustum, *Lasioglossum*, 168
peruvianus, *Leioproctus*, 41
pervarians, *Homalictus*, 181
perviridis, *Palaeorhiza*, 146
Phaenosarus, 206
phanerodontus, *Leioproctus*, 63
phanerura, *Nomia*, 157
phaola, *Chalicodoma*, 204
pharcidodes, *Leioproctus*, 41
Pharohylaeus, 141, 324
Phenacolletes, 73
phenacopyga, *Megachile*, 209
phenacura, *Nomia*, 159
philippinensis, *Nomia*, 157
phillipensis, *Chalicodoma*, 198
phillipensis, *Homalictus*, 180
phillipensis, *Leioproctus*, 51
philoleucus, *Hylaeus*, 127
philonesus, *Leioproctus*, 51
philoxantha, *Euryglossina*, 109
picea, *Euryglossa*, 94
picta, *Callomelitta*, 39
picta, *Euryglossa*, 96
picticorne, *Lasioglossum*, 173
pictifrons, *Exoneura*, 226
pictiventris, *Megachile*, 209
pictulus, *Hylaeus*, 123
pictus, *Hylaeus*, 123
pictus, *Leioproctus*, 42, 63
pilicollis, *Lasioglossum*, 168
pilipes, *Nomia*, 157
Pithitis, 221
placida, *Megachile*, 210
planifrons, *Trigona*, 231
platycephalum, *Lasioglossum*, 177
platycephalus, *Leioproctus*, 51
platyrhina, *Euryglossa*, 91
Platytrigona, 231
Plebeia, 230
plebeia, *Allodapula*, 223
plebeia, *Pachyprosopis*, 106
Plebeiella, 230
Plebeina, 230
plebeium, *Lasioglossum*, 177
plebeius, *Leioproctus*, 51
pleurinotatus, *Thyreus*, 219
plorator, *Lasioglossum*, 165
ploratula, *Exoneura*, 226, 242
plumatus, *Paracolletes*, 78
plumosa, *Nomia*, 160, 306
plumosellus, *Leioproctus*, 51
plumosus, *Leioproctus*, 51, 55
pluto, *Chalicodoma*, 192
poecilosoma, *Palaeorhiza*, 146
politifrons, *Euryglossa*, 94
polyesia, *Parevaspis*, 214
Polyglossa, 42
polygoni, *Lasioglossum*, 177
polysticta, *Euryglossa*, 94
porteri, *Leioproctus*, 42
portlandensis, *Halictus*, 162
portlandiana, *Chalicodoma*, 203
portlandicus, *Homalictus*, 181
praesumptiosa, *Allodapula*, 223
preissi, *Amegilla*, 218
preissi, *Chalicodoma*, 198
pretiosa, *Chalicodoma*, 191
Previous studies, 24
primaria, *Euryglossa*, 96, 280
primulipictus, *Hylaeus*, 123
proctotrypoides, *Euryglossina*, 109
procurvus, *Hylaeus*, 137
profugus, *Sphecodes*, 182
propinqua, *Ceratina*, 221
Prosopis, 117
Prosopistemon, 120, 137
Protodiscelis, 42
Protomorpha, 56
provida, *Xylocopa*, 229
providellus, *Leioproctus*, 51
providus, *Leioproctus*, 51
proxima, *Euryglossa*, 94
proximum, *Lasioglossum*, 168
proximus, *Hylaeus*, 126

- proximus*, *Leioproctus*, 66, 69
Proxyllocopa, 226
Pseudapis, 157
pseudexterus, *Homalictus*, 181
Pseudhylaesus, 135
Pseudobranchiata, 120
Pseudocentron, 206
pseudoceratina, *Nomia*, 159
Pseudochilalictus, 170, 324
pseudocoronata, *Xyllocopa*, 229
Pseudomegachile, 187
pseudozonatus, *Leioproctus*, 41
psilocera, *Nomada*, 214
Psithyrus, 229
Ptilonomia, 160, 324
Ptilosarus, 206
Ptilotrígona, 231
pubescens, *Stenotritus*, 83
pulchellus, *Thyreus*, 219
pulcherrimus, *Trichocolletes*, 80, 265
pulchra, *Amegilla*, 217
pulchra, *Nomia*, 156
pulchribalteata, *Nomia*, 156
pulchricrus, *Hylaeus*, 127
pulchripes, *Heterapoides*, 138
pulvitectum, *Lasioglossum*, 177, 240
punctata, *Amegilla*, 218
punctata, *Chalicodoma*, 198
punctata, *Euryglossa*, 94
punctata, *Exoneura*, 226
punctata, *Meroglossa*, 151, 238
punctatissimum, *Lasioglossum*, 168
punctatus, *Homalictus*, 181, 241
punctatus, *Leioproctus*, 51
puncticollis, *Megachile*, 210
punctiventris, *Leioproctus*, 52
punctulata, *Nomia*, 156
puernongense, *Lasioglossum*, 177
puernongensis, *Nomia*, 157
puernongensis, *Pachyprosopis*, 107
purpurascens, *Leioproctus*, 69
purpurascens, *Palaeorhiza*, 146
purpuratus, *Hylaeus*, 132
purpureocincta, *Palaeorhiza*, 146
purpureus, *Homalictus*, 181
purpureus, *Leioproctus*, 52
pusillus, *Leioproctus*, 55
Pycnanthidium, 213

quadratus, *Hylaeus*, 123, 236
quadriceps, *Hylaeus*, 123
quadridentata, *Nomia*, 154
quadrifasciata, *Amegilla*, 216
quadrifasciata, *Nomia*, 154, 156
quadrifasciata, *Euryglossa*, 96
quadrifasciatus, *Thyreus*, 219
quadrinotatus, *Thyreus*, 219
quadripunctata, *Trígona*, 230

quartinae, *Thyreus*, 219
quinguelineata, *Megachile*, 209, 242
quodi, *Megachile*, 187

radoszkowskyi, *Thyreus*, 219
raffae, *Euryglossa*, 96
rainbowi, *Euryglossa*, 91
ralunensis, *Sphecodes*, 183
ralunicolus, *Homalictus*, 181
ramakrishnae, *Anihidiellum*, 213
rambutwan, *Chalicodoma*, 191
ramulipes, *Chalicodoma*, 198
rangii, *Chalicodoma*, 191
rasorium, *Anthidiellum*, 213
raymenti, *Homalictus*, 181
raymenti, *Leioproctus*, 55
rebellis, *Paracolletes*, 78
recantans, *Lasioglossum*, 168
recessiva, *Palaeorhiza*, 146
recessum, *Lasioglossum*, 168
recisa, *Chalicodoma*, 203
rectangulatus, *Leioproctus*, 69
rectitudo, *Palaeorhiza*, 146
recusus, *Leioproctus*, 52
Reepenina, 159
regalis, *Leioproctus*, 52
regalis, *Palaeorhiza*, 146
regina, *Chalicodoma*, 191
regina, *Palaeorhiza*, 146
reginae, *Coelioxys*, 212
reginae, *Euryglossa*, 94, 234
reginae, *Nomia*, 157
reginarum, *Palaeorhiza*, 146
regis, *Nomia*, 157
rejecta, *Palaeorhiza*, 146
rejectus, *Leioproctus*, 69
relegatus, *Hylaeus*, 123
relicta, *Chalicodoma*, 198
remeata, *Chalicodoma*, 198
remotula, *Chalicodoma*, 203
repertulum, *Lasioglossum*, 173
repertum, *Lasioglossum*, 177
repraesentans, *Lasioglossum*, 177
resinifera, *Chalicodoma*, 203
reticulosum, *Lasioglossum*, 173
reticulosus, *Pachyhalictus*, 338
revicta, *Chalicodoma*, 198
rhodochlora, *Euryglossa*, 94
rhododendri, *Megachile*, 210
rhododonta, *Nomia*, 156
rhodogastra, *Megachile*, 209, 242
Rhodohylaeus, 124, 324
Rhodomegachile, 201, 324
rhodoptera, *Exoneura*, 226
rhodopterum, *Lasioglossum*, 168
rhodopus, *Leioproctus*, 52
rhodoscymna, *Amegilla*, 218
rhodura, *Chalicodoma*, 198

- rhodurus*, *Leioproctus*, 59, 253
Rhopalomelissa, 157
ricae, *Euryglossa*, 91
richardsoni, *Exoneura*, 226
rickae, *Amegilla*, 218
ridens, *Euryglossa*, 91, 96
ridleyi, *Nomia*, 154
rieki, *Hylaeus*, 137, 298
risbeci, *Homalictus*, 181
robbii, *Lasioglossum*, 173
robusta, *Dasyhesma*, 103, 284
robusta, *Exoneura*, 226, 243
robustus, *Hylaeus*, 133
robustus, *Paracolletes*, 78
roddiana, *Exoneura*, 226
rollei, *Hylaeus*, 118, 130
roseoviridis, *Leioproctus*, 52
rotnestensis, *Chalicodoma*, 203
rotundatus, *Thyreus*, 219
rotundiceps, *Hylaeus*, 132
rowlandi, *Homalictus*, 181
rowlandi, *Hylaeus*, 129
rowlandi, *Megachile*, 209
rubella, *Nomia*, 159
rubellis, *Leioproctus*, 52
rubellus, *Paracolletes*, 78
ruberrima, *Euryglossa*, 94
rubiginosus, *Leioproctus*, 69
rubini, *Nomada*, 214
rubra, *Nomia*, 157
rubricata, *Amegilla*, 218
rubricata, *Euryglossa*, 94
rubricata, *Leioproctus*, 69
rubricata, *Meroglossa*, 151
rubricatus, *Lithurge*, 185, 241
rubripes, *Hylaeus*, 126
rubriventre, *Lasioglossum*, 168
rubriventris, *Leioproctus*, 41
rubroviridis, *Nomia*, 156
runderatus, *Bombus*, 229
rudis, *Leioproctus*, 52
rudissimus, *Leioproctus*, 55
rufa, *Amegilla*, 218
rufa, *Exoneura*, 226
rufapicata, *Chalicodoma*, 198
rufescens, *Amegilla*, 218
rufibase, *Lasioglossum*, 171
rufibasis, *Trichocolletes*, 80
ruficauda, *Euryglossa*, 94
ruficaudus, *Leioproctus*, 66
ruficeps, *Hylaeus*, 132, 237
ruficollaris, *Hyleoides*, 151
ruficolle, *Lasioglossum*, 170
ruficornis, *Leioproctus*, 52, 64
ruficornis, *Nomada*, 214
ruficornis, *Nomia*, 157
rufipennis, *Leioproctus*, 42
rufipes, *Anthidiellum*, 213
rufipes, *Hylaeus*, 126
rufipes, *Lasioglossum*, 165
rufipes, *Leioproctus*, 52
rufitarsis, *Exoneura*, 226
rufitarsus, *Lasioglossum*, 165
rufitarsus, *Thyreus*, 219
rufithorax, *Leioproctus*, 41
rufiventris, *Euryglossa*, 91, 273
rufiventris, *Leioproctus*, 41, 66
rufoaeneus, *Homalictus*, 181
rufoaeneus, *Leioproctus*, 52
rufocaudata, *Megachile*, 210
rufocincta, *Hyleoides*, 151
rufocoeruleus, *Leioproctus*, 41
rufocognita, *Nomia*, 157
rufocollare, *Lasioglossum*, 170
rufocollaris, *Stenotritus*, 83
rufolobata, *Chalicodoma*, 198
rufomaculata, *Chalicodoma*, 203
rufopilosa, *Megachile*, 209
rufopilosus, *Trichocolletes*, 80
rufotegulare, *Lasioglossum*, 168
rufotinctum, *Lasioglossum*, 177
rufulum, *Lasioglossum*, 168
rufus, *Trichocolletes*, 80
rugicollis, *Chalicodoma*, 191
rugosa, *Callomelitta*, 39
rugosa, *Chalicodoma*, 198
ruizi, *Leioproctus*, 41
rutilans, *Xylocopa*, 229
saffordi, *Homalictus*, 181
saigonensis, *Megachile*, 210
salaris, *Euryglossa*, 94
salsettense, *Lasioglossum*, 173
saltensis, *Leioproctus*, 41
salteri, *Amegilla*, 217, 242
Samoa, 16, 25
samoae, *Homalictus*, 181
sandacanensis, *Gephyrohylaeus*, 139, 300
sanguinipes, *Lasioglossum*, 177
sanguinipictus, *Hylaeus*, 123
sanguinosa, *Euryglossa*, 95
sapiens, *Amegilla*, 217
sapiens, *Trigona*, 231
Sarogaster, 187
sasakiella, *Chalicodoma*, 204
satelles, *Nomia*, 157
saturina, *Pachyprosopis*, 107
savaiensis, *Homalictus*, 181
Sayapis, 206
saycei, *Homalictus*, 181
scabrosus, *Lithurge*, 185
Schizomegachile, 199, 324
schmiedeknechti, *Lasioglossum*, 173
schomburgki, *Euryglossa*, 95
schomburgki, *Lasioglossum*, 168
Schonherria, 227

- schrottkyi*, *Trigona*, 230
Schwarziana, 230
scintillans, *Hylaeus*, 123
scintilliformis, *Hylaeus*, 123
scintillus, *Hylaeus*, 123
scitulus, *Leioproctus*, 52
Scope, 5
Scapter, 42, 98
scrupulosus, *Homalictus*, 181, 241
sculpta, *Heierapoides*, 138
sculptifrons, *Amphylaeus*, 149
sculptissima, *Meroglossa*, 151
sculpturatum, *Lasioglossum*, 177
scuticornis, *Hylaeus*, 137, 238, 299
scutellaris, *Euryglossa*, 96, 280
scutellaris, *Thyreus*, 218
scutellata, *Euryglossa*, 95
scutellata, *Megachile*, 209
scutellatum, *Lasioglossum*, 168
scymna, *Amegilla*, 218
secunda, *Megachile*, 209
seductum, *Lasioglossum*, 177
semiaurea, *Nomia*, 157
semicandens, *Chalicodoma*, 198
semicastaneus, *Hylaeus*, 126
semiclara, *Megachile*, 212
semicyaneus, *Homalictus*, 181
semicyaneus, *Leioproctus*, 42
semiflava, *Euryglossina*, 109, 235
semilautus, *Leioproctus*, 52
semilucens, *Leioproctus*, 52
semiluctuosa, *Chalicodoma*, 198, 323
seminitens, *Lasioglossum*, 177
semipallida, *Nomia*, 157
semipolitum, *Lasioglossum*, 173
semipurpurea, *Euryglossina*, 109
semipersonatus, *Hylaeus*, 123
semipurpureus, *Leioproctus*, 52, 233
semirufus, *Hylaeus*, 127
semisculptum, *Lasioglossum*, 173
semisericea, *Holoheuma*, 86, 102, 234
semivestita, *Chalicodoma*, 191
semiviridis, *Leioproctus*, 52
senescens, *Lasioglossum*, 173
senex, *Chalicodoma*, 191
senex, *Megachile*, 209
sequior, *Megachile*, 209
sericeicauda, *Chalicodoma*, 198
sericeus, *Trichocolletes*, 80
serotinellus, *Hylaeus*, 123, 236
serrata, *Euryglossa*, 91
serricauda, *Megachile*, 209
sevillensis, *Homalictus*, 181
sexmaculata, *Chalicodoma*, 203
sexmaculatus, *Leioproctus*, 52
sextum, *Lasioglossum*, 168
seydi, *Leioproctus*, 41
shafferyella, *Amegilla*, 217
shortlandi, *Megachile*, 209
sicarius, *Thyreus*, 219
sicheli, *Nomia*, 157
sigillatus, *Leioproctus*, 52
sigiriellum, *Lasioglossum*, 173
sigiriellus, *Pachyhalictus*, 338
Sigmatapis, 232
silvestrii, *Trigona*, 231
silvestris, *Chalicodoma*, 198
similior, *Leioproctus*, 66
similis, *Hylaeus*, 123
similis, *Leioproctus*, 41
similis, *Megachile*, 209
simillima, *Allodapula*, 223, 242
simillima, *Exoneura*, 226
simillima, *Nomia*, 161
simillima, *Xylocopa*, 229
simillimus, *Hylaeus*, 126, 130
simillimus, *Leioproctus*, 52, 66, 69
simplex, *Hylaeus*, 114, 123, 291
simplex, *Megachile*, 209
simpliciformis, *Chalicodoma*, 198
simplicinotum, *Nomia*, 161, 309
simplicior, *Neopasiphae*, 75, 262
simpliciventris, *Hylaeus*, 129, 237
simulator, *Leioproctus*, 52
sinapina, *Euryglossa*, 86, 96
sinapipes, *Euryglossa*, 96
singhalensis, *Homalictus*, 181
singularis, *Leioproctus*, 69
smaragdinus, *Ctenocolletes*, 83
smaragdula, *Ceratina*, 221
smithella, *Nomia*, 157
smithi, *Parevaspis*, 214
Smithia, 98
smithii, *Anthidiellum*, 213
smithii, *Coelioxys*, 212
smithii, *Hylaeus*, 130
smithii, *Lasioglossum*, 171
socialis, *Apis*, 232
solis, *Lasioglossum*, 168
Solomon Islands, 11, 18, 25
solomonis, *Anthidiellum*, 213
sordida, *Amegilla*, 218
sordidula, *Amegilla*, 218
sordidulum, *Lasioglossum*, 168
sordidum, *Lasioglossum*, 171
soror, *Meroglossa*, 151
sparsa, *Euryglossa*, 95
spatulatus, *Leioproctus*, 52
speciosus, *Ctenocolletes*, 83
speculellum, *Lasioglossum*, 173
speculiferum, *Lasioglossum*, 168, 239
speculiferus, *Leioproctus*, 55, 233
speculithorax, *Lasioglossum*, 173
spgazzinii, *Leioproctus*, 41
speluncarum, *Chalicodoma*, 198

- spenceri*, *Lasioglossum*, 177
Sphaerhylaesus, 129
Sphecodes, 182
sphecodoides, *Homalictus*, 181
sphecodopsis, *Homalictus*, 181
Spilomena, 109
spinolae, *Leioproctus*, 41
Spinolapis, 41
spissula, *Chalicodoma*, 204
splendidulum, *Lasioglossum*, 173
splendidus, *Stenotritus*, 83
spryi, *Hylaeorhiza*, 142
stalkeri, *Chalicodoma*, 198
stalkeri, *Nomia*, 157
Stelodides, 187
Stenocolletes, 42
Stenohesma, 99, 324
Stenotritinae, 80
Stenotritus, 82
stevensoni, *Echthralictus*, 182
stewarti, *Leioproctus*, 52
stictus, *Leioproctus*, 41
stilborhinus, *Leioproctus*, 41
Stilpnosoma, 100
stirlingi, *Lasioglossum*, 173
stirling, *Pachyhalictus*, 338
stradbrokensis, *Homalictus*, 181
Strandiella, 42
strangulatus, *Homalictus*, 181
striaticeps, *Meroglossa*, 151
striatula, *Hyleoides*, 151
striatulus, *Leioproctus*, 69
striatus, *Hylaeus*, 123
strigata, *Anthidiellum*, 213
strigata, *Nomia*, 154, 156
strigata, *Pachyprosopis*, 107
strigosa, *Euryglossa*, 96
Structure, 27
stuchilum, *Lasioglossum*, 168
sturti, *Lasioglossum*, 173
stygica, *Palaeorhiza*, 146, 302
subabdominalis, *Chalicodoma*, 198
subatrella, *Megachile*, 187
subaustralica, *Nomia*, 157
subbaculifera, *Exoneura*, 226
subcarus, *Homalictus*, 181
subconstrictus, *Hylaeus*, 126
subcoronatus, *Hylaeus*, 123
subdentatus, *Leioproctus*, 63
subdulus, *Leioproctus*, 52
suberythrurum, *Lasioglossum*, 177
subetheridgei, *Lasioglossum*, 177
subexcavata, *Exoneura*, 226
subexterus, *Homalictus*, 181
subferox, *Chalicodoma*, 203
subfultoni, *Lasioglossum*, 168
subfusa, *Euryglossa*, 95
subfuscus, *Paracolletes*, 78
subhamulata, *Exoneura*, 226
subhonestus, *Hylaeus*, 131
subinclinans, *Lasioglossum*, 177, 240
subinconspicua, *Euryglossa*, 91
sublateralis, *Hylaeus*, 126
submacrodonatus, *Paracolletes*, 78
submeracum, *Lasioglossum*, 168
subminutus, *Leioproctus*, 52
submoerens, *Nomia*, 157
submoratum, *Lasioglossum*, 168
subnothula, *Euryglossina*, 111, 235
subnubilosa, *Hylaeorhiza*, 142
subpallidifrons, *Homalictus*, 181
subplebeium, *Lasioglossum*, 177
subplebeius, *Hylaeus*, 126
subpunctatus, *Leioproctus*, 52
subpurpurea, *Nomia*, 154
subremotula, *Chalicodoma*, 198
subrussatum, *Lasioglossum*, 168
subsalteri, *Amegilla*, 217
subsericea, *Euryglossa*, 95, 234
subsericeicauda, *Megachile*, 209
subsericeicauda, *Chalicodoma*, 198
subterraneus latreillellus, *Bombus*, 229
subtilis, *Melittosmithia*, 99
suburbanus, *Homalictus*, 181, 241
subvigilans, *Leioproctus*, 63
subviridis, *Leioproctus*, 52
suffusipennis, *Chalicodoma*, 198, 242
sulcifrons, *Hylaeus*, 123
sulcifrons, *Meroglossa*, 151
sulphurea, *Euryglossa*, 96, 276
sulphurella, *Brachyhesma*, 114
sulthicum, *Lasioglossum*, 168
supralucens, *Lasioglossum*, 177
suvaensis, *Homalictus*, 181
swainsoniae, *Nomia*, 154
swalei, *Anthidiellum*, 213
swarbrecki, *Megachile*, 187
swezeyi, *Homalictus*, 181
sybilae, *Amegilla*, 217
sydneyana, *Meroglossa*, 151
sydneyanus, *Hylaeus*, 131
sydneyensis, *Amphylaeus*, 148
Symbols, 25, 26
symei, *Trigona*, 230
Systematic treatment, 33
szentivanyi, *Chalicodoma*, 191, 321
szentivanyi, *Homalictus*, 181
taclobanensis, *Homalictus*, 177, 181
Tahiti, 11, 18
takaoensis, *Creightonella*, 206
talchium, *Lasioglossum*, 168
taluche, *Lasioglossum*, 168
tamburinei, *Lasioglossum*, 177
tamulicum, *Lasioglossum*, 173
tannaensis, *Homalictus*, 181

- tarltoni*, *Homalictus*, 181
tarsalis, *Leioproctus*, 56
tarsata, *Euryglossa*, 87
tarsatula, *Chalicodoma*, 204
tasmani, *Hylaeorhiza*, 142
 Tasmania, 11, 16, 25
tasmaniae, *Lasioglossum*, 177
tasmanica, *Chalicodoma*, 198
tasmanica, *Exoneura*, 226
tasmanica, *Euryglossa*, 91
tasmanicus, *Hylaeus*, 127
tatei, *Homalictus*, 181
tau, *Exoneura*, 226, 243
taua, *Megachile*, 187
tenuicincta, *Megachile*, 209
tenuicinctus, *Paracolletes*, 78
tenuicornis, *Euryglossa*, 95
tenuiculus, *Trichocolletes*, 80
tenuihirta, *Nomia*, 157
tenuis, *Homalictus*, 181
tepperi, *Lasioglossum*, 169
terminalis, *Chalicodoma*, 191
terminata, *Euryglossa*, 95
terrestris, *Bombus*, 229
tertia, *Chalicodoma*, 191
tertium, *Lasioglossum*, 165
testacea, *Nomia*, 160, 306
testaceipes, *Nomia*, 157
testaciventre, *Lasioglossum*, 169
Tetraglossula, 40
tetraxaniha, *Palaeorhiza*, 146
tetrazonata, *Nomia*, 153
Tetragobula, 231
Tetragona, 230
Tetragonilla, 231
Tetragonisca, 231
Tetrigona, 231
Thaumatosoma, 200
theodorei, *Hylaeus*, 129, 237
thor, *Homalictus*, 181
thor, *Nomia*, 157
thoracica, *Euryglossa*, 95
thoracica, *Trigona*, 231
thoracicus, *Leioproctus*, 41
thornleighensis, *Leioproctus*, 52
thorogoodi, *Amegilla*, 217
Thyreus, 218
tilachiforme, *Lasioglossum*, 169
tilachum, *Lasioglossum*, 169
 Timor, 18
tinctus, *Thyreus*, 219
tinsleyella, *Amegilla*, 217
tomentella, *Chalicodoma*, 198
tomentifera, *Nomia*, 161
tomentosa, *Chalicodoma*, 191
 Tonga, 16
tonganus, *Homalictus*, 181
tooloomense, *Lasioglossum*, 170
 Torres Strait, 15
torrida, *Meroglossa*, 151, 238
tosticauda, *Chalicodoma*, 199
townleyella, *Amegilla*, 217
toxopei, *Homalictus*, 181
toxopei, *Megachile*, 187
toxopeusi, *Homalictus*, 181
transvolans, *Homalictus*, 181
triangularis, *Nomia*, 159
triangulata, *Meroglossa*, 151
triangulifera, *Nomia*, 160
tribuarium, *Lasioglossum*, 169
Trichocolletes, 78, 79
trichognatha, *Chalicodoma*, 199, 242
trichomarginata, *Chalicodoma*, 199
Trichota, 135
tringulum, *Lasioglossum*, 171
tricolor, *Euryglossa*, 95
tricolor, *Homalictus*, 181, 319
tridentata, *Nomia*, 156
tridentifrons, *Euryglossa*, 95
Trigona, 230
trigonoides, *Meroglossa*, 151
trilobata, *Hylaeus*, 123
trimaculatum, *Lasioglossum*, 169
trimerops, *Hylaeus*, 123
tripunctatum, *Lasioglossum*, 169
tristis, *Leioproctus*, 41
trizonulum, *Lasioglossum*, 173
trizonulus, *Pachyhalictus*, 338
tropicalis, *Leioproctus*, 56
truncatulus, *Leioproctus*, 52, 233
 Tuamotu Archipelago, 18, 122
tuamotuensis, *Hylaeus*, 123, 292
tuberculata, *Euryglossa*, 91
tuberculata, *Meroglossa*, 151
tuberculatus, *Leioproctus*, 63
tuberculifrons, *Nomia*, 154
tuberculipes, *Euryglossa*, 92, 275
tuchilas, *Lasioglossum*, 169
tumorifera, *Xylocopa*, 229
turgicollaris, *Hylaeus*, 123
Turnerella, 109
turneri, *Anthidiellum*, 213
turneri, *Chalicodoma*, 199
turneri, *Euryglossa*, 95
turneri, *Exoneura*, 226
turneri, *Hylaeus*, 123
turneri, *Lasioglossum*, 169
turneri, *Leioproctus*, 63, 233
turneri, *Nomia*, 157
turneri, *Stilpnosoma*, 101
turneri, *Thyreus*, 219
turneriana, *Palaeorhiza*, 146
turnerorum, *Callomelitta*, 39
tutuila, *Homalictus*, 181
tutuila, *Megachile*, 209
Tylomegachile, 206

- ulongensis*, *Nomia*, 157
umbripennis, *Chalicodoma*, 191
undulata, *Euryglossa*, 91
unguidentatus, *Leioproctus*, 52, 233, 247
unicolor, *Allodapula*, 223, 242
unicolor, *Xylocopa*, 229
upoluensis, *Homalictus*, 181
urbanus, *Homalictus*, 181, 241
Urocolletes, 58, 324
ustulata, *Chalicodoma*, 199
ustulatiformis, *Megachile*, 210

vagans, *Lasioglossum*, 173
variabilis, *Euryglossa*, 95
variabilis, *Exoneura*, 226, 243
variabilis, *Nomia*, 160
varicolor, *Palaeorhiza*, 146
variegata, *Allodapula*, 221
variegata, *Euryglossa*, 95
varicolor, *Palaeorhiza*, 146
vau, *Lasioglossum*, 169
vavauensis, *Megachile*, 209
velutina, *Xylocopa*, 229
velutinellus, *Leioproctus*, 71
velutinus, *Leioproctus*, 66, 71
ventralis, *Euryglossa*, 95
ventralis, *Leioproctus*, 41, 42
ventralis, *Megachile*, 209
venustus, *Trichocolletes*, 80, 234
vermiculatum, *Lasioglossum*, 169
veronicae, *Lasioglossum*, 177
versicolor, *Leioproctus*, 52
versifrons, *Homalictus*, 181
verticalis, *Thyreus*, 219
vestitor, *Megachile*, 212
vestitus, *Leioproctus*, 52
vicinus, *Hylaeus*, 132
victoriae, *Chalicodoma*, 199
victoriae, *Coelioxys*, 212
victoriae, *Euryglossa*, 95
victoriae, *Lasioglossum*, 177
victoriae, *Nomia*, 157
victoriae, *Stenotritus*, 83
victoriellum, *Lasioglossum*, 177
victoriensis, *Amegilla*, 218
viduus, *Hylaeus*, 133
vigilans, *Leioproctus*, 63
villosula, *Euryglossa*, 96
vinctum, *Lasioglossum*, 173
vinctus, *Pachyhalictus*, 338
violacea, *Lestis*, 228
violacea, *Palaeorhiza*, 146
violacea, *Xylocopa*, 228
violacella, *Palaeorhiza*, 146
violaceus, *Hylaeus*, 131
violascens, *Lestis*, 228
viridarii, *Lasioglossum*, 177
viridescens, *Leioproctus*, 69

viridibasis, *Leioproctus*, 52
viridicincta, *Nomia*, 154
viridicinctus, *Leioproctus*, 52
viridifrons, *Palaeorhiza*, 146
viridilimbata, *Nomia*, 154
viridimutans, *Palaeorhiza*, 146
viridinitens, *Chalicodoma*, 191
viridinitens, *Homalictus*, 181
viridiscitus, *Homalictus*, 181
vitrifrons, *Leioproctus*, 69
vitripenne, *Lasioglossum*, 177, 240
vittatifrons, *Hylaeus*, 124
vittatus, *Paracolletes*, 78
vittipennis, *Hylaeus*, 124
viduum, *Lasioglossum*, 177
volatilis, *Hylaeus*, 129
vulneratum, *Lasioglossum*, 169

wagneri, *Leioproctus*, 41
wahlenbergiae, *Euryglossa*, 91, 234, 274
wahlenbergiae, *Lasioglossum*, 177, 240, 317
wahlenbergiae, *Leioproctus*, 56, 233, 250
walker, *Amegilla*, 217
walkeriana, *Euryglossa*, 91, 234
wallabia, *Xylocopa*, 229
Wallacea, 17
wallacei, *Amegilla*, 217
wallacei, *Thyreus*, 219
wallaciella, *Amegilla*, 217
warburtoni, *Lasioglossum*, 169
waroonensis, *Thyreus*, 219
waterhousei, *Hyleoides*, 151
waterhousei, *Lasioglossum*, 169
waterhousei, *Leioproctus*, 53
waterhousei, *Megachile*, 209
websteri, *Trigona*, 230
weinlandi, *Coelioxys*, 213
wellingtoni, *Lasioglossum*, 169
westwoodi, *Nomia*, 156
whiteleyella, *Amegilla*, 217
whiteleyi, *Lasioglossum*, 177
willei, *Nomia*, 157
williamsi, *Homalictus*, 181
williamsi, *Nomia*, 159
willsi, *Lasioglossum*, 177
wilmattae, *Lasioglossum*, 169
wilmattae, *Megachile*, 209
wilmattae, *Nomia*, 157
wilsoni, *Callomelitta*, 39
wilsoni, *Chalicodoma*, 199
wilsoni, *Homalictus*, 181
wilsoni, *Hylaeus*, 124
wilsoni, *Leioproctus*, 71
woodfordi, *Megachile*, 209
woodsi, *Homalictus*, 181
worsfoldi, *Leioproctus*, 52
woyensis, *Hylaeus*, 124
woyensis, *Leioproctus*, 55

wybenica, *Trigona*, 231
wyndhamensis, *Megachile*, 210
wynardensis, *Hylaeus*, 124

xanthaspis, *Hylaeus*, 124
Xanthesma, 91, 97, 324
xanthoclypeata, *Exoneura*, 226
xanthocollaris, *Hylaeus*, 123, 129
xanthodonta, *Pachyprosopis*, 107
xanthogastra, *Nomia*, 159
xanthogena, *Euryglossina*, 111
xanthognathus, *Hylaeus*, 124
xanthopus, *Lasioglossum*, 171
xanthopsyche, *Hylaeus*, 124
Xanthosarus, 206
xanthosphaerus, *Hylaeus*, 131
xanthopoda, *Hylaeus*, 129
xenoceratus, *Leioproctus*, 61, 254
Xenohesma, 90, 96, 97, 324
Xenohylaeus, 136, 324
Xenorhiza, 146, 324
Xeromegachile, 206

xerophila, *Xylocopa*, 229
Xylocopa, 228
Xylocopa, 228
Xylocopinae, 219
Xylocopini, 226

yapensis, *Homalictus*, 181

zachlorus, *Homalictus*, 181
Zalygus, 111
zamelanum, *Lasioglossum*, 170
zebra, *Anthidiellum*, 213
zebrae, *Nomia*, 160
ziegleri, *Exoneura*, 226
zingowli, *Homalictus*, 181
zingowli, *Megachile*, 210
zonalis, *Hyleoides*, 151
zonalis, *Leioproctus*, 41
Zonamegilla, 216
zonata, *Amegilla*, 217
zonatus, *Leioproctus*, 41

PLATES 1-15

PLATE 1

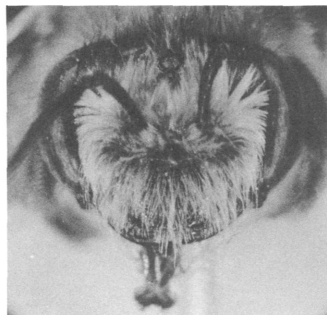
1. *Callomelitta antipodes* (Smith), male; $\times 15.5$. 2. *Callomelitta antipodes* (Smith), female; $\times 15.5$. 3. *Leioproctus* (*Leioproctus*) *megachalcoides*, new species, holotype female; $\times 7.5$. 4. *Leioproctus* (*Leioproctus*) *unguidentatus*, new species, holotype female; $\times 14$. 5. *Leioproctus* (*Nesocolletes*) *fulvescens* (Smith), female; $\times 11$. 6. *Leioproctus* (*Cladocerapis*) *incanescens* (Cockerell), female; $\times 11$. 7. *Leioproctus* (*Cladocerapis*) *incanescens* (Cockerell), male; $\times 11$. 8. *Leioproctus* (*Microcolletes*) *wahlenbergiae*, new species, holotype female; $\times 14$. 9. *Leioproctus* (*Microcolletes*) *wahlenbergiae*, new species, allotype male; $\times 14$. 10. *Leioproctus* (*Microcolletes*) *microsomus*, new species, holotype female; $\times 14$. 11. *Leioproctus* (*Microcolletes*) *finkei*, new species, paratype female; $\times 14$. 12. *Leioproctus* (*Excolletes*) *impatellatus*, new species, holotype female; $\times 14$.



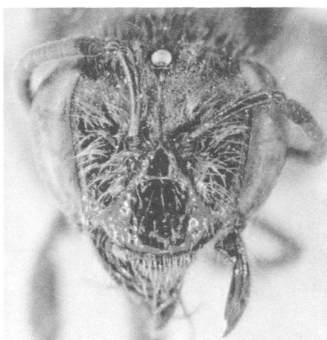
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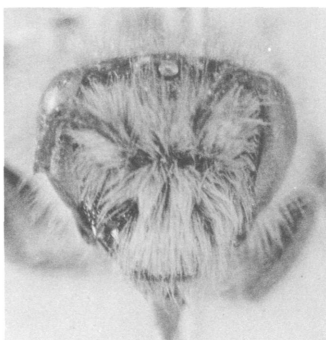
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3



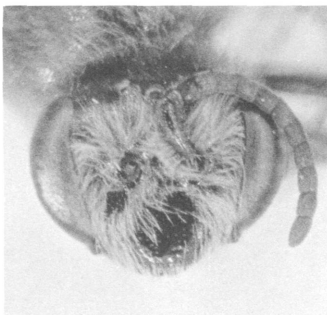
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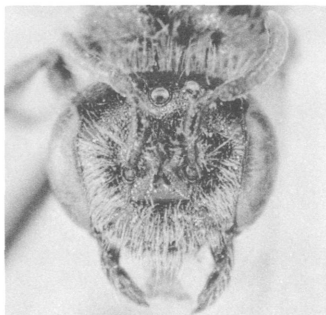
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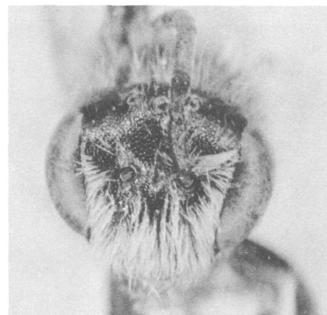
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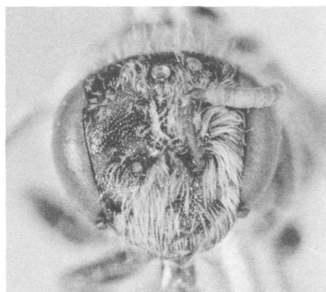
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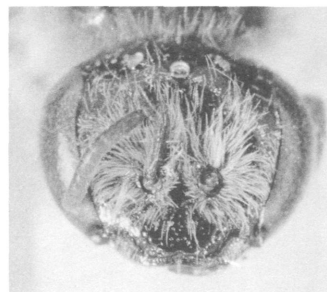
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10



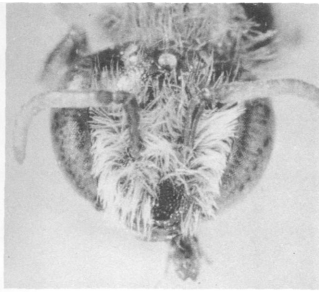
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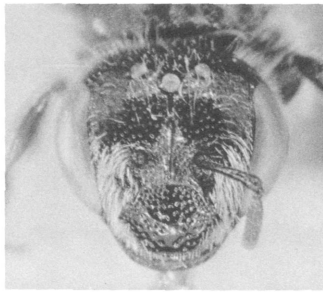
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PLATE 2

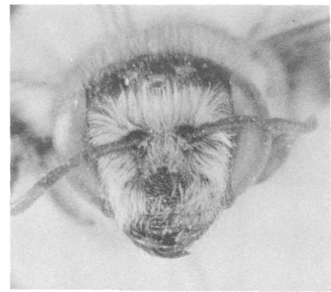
1. *Leioproctus* (*Excolletes*) *impatellatus*, new species, paratype male; $\times 14$.
2. *Leioproctus* (*Colletopsis*) *contrarius*, new species, holotype female; $\times 11$.
3. *Leioproctus* (*Urocolletes*) *rhodurus*, new species, female type; $\times 7.5$.
4. *Leioproctus* (*Anacolletes*) *bimaculatus* (Smith), female; $\times 11$.
5. *Leioproctus* (*Anacolletes*) *bimaculatus* (Smith), male; $\times 11$.
6. *Leioproctus* (*Glossurocolletes*) *xenoceratus*, new species, holotype male; $\times 11$.
7. *Leioproctus* (*Glossurocolletes*) *bilobatus*, new species, holotype male; $\times 14$.
8. *Leioproctus* (*Nodocolletes*) *caeruleotinctus* (Cockerell), female; $\times 11$.
9. *Leioproctus* (*Nodocolletes*) *caeruleotinctus* (Cockerell), male; $\times 11$.
10. *Leioproctus* (*Nodocolletes*) *pacificus*, new species, holotype male; $\times 11$.
11. *Leioproctus* (*Ceratocolletes*) *andreniformis* (Cockerell), female; $\times 9$.
12. *Leioproctus* (*Goniocolletes*) *morsus* (Cockerell), male; $\times 9$.



1



2



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4



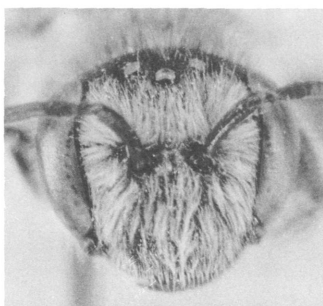
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6



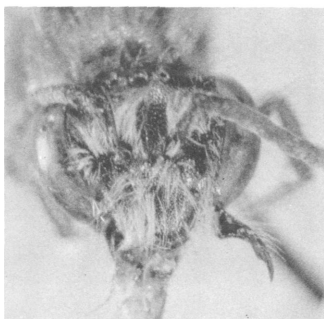
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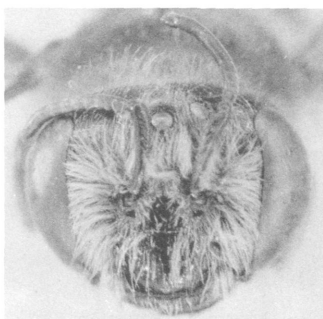
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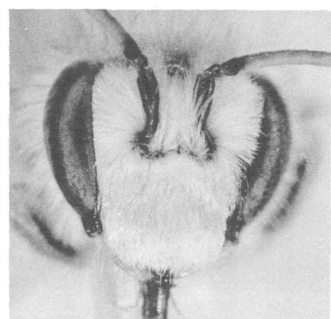
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11



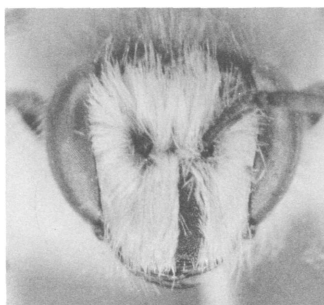
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PLATE 3

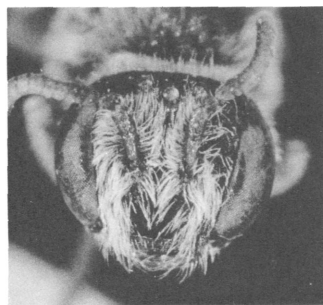
1. *Leioproctus* (*Goniocolletes*) *dolosus*, new species, allotype female; $\times 9$.
2. *Leioproctus* (*Goniocolletes*) *dolosus*, new species, holotype male; $\times 9$.
3. *Leioproctus* (*Baeocolletes*) *mas*, new species, holotype male; $\times 14$.
4. *Leioproctus* (*Baeocolletes*) *calcaratus*, new species, holotype female; $\times 14$.
5. *Leioproctus* (*Baeocolletes*) *minimus*, new species, holotype male; $\times 18.5$.
6. *Leioproctus* (*Andrenopsis*) *douglasiellus*, new species, holotype female; $\times 11$.
7. *Leioproctus* (*Andrenopsis*) *nigrifrons*, new species, holotype male; $\times 14$.
8. *Leioproctus* (*Chrysocolletes*) *moretonianus* (Cockerell), male; $\times 11$.
9. *Leioproctus* (*Chrysocolletes*) *moretonianus* (Cockerell), female; $\times 11$.
10. *Leioproctus* (*Chrysocolletes*) *crenulatus*, new species, holotype male; $\times 7.5$.
11. *Leioproctus* (*Phenacolletes*) *mimus* (Cockerell), male; $\times 7.5$.
12. *Neopasiphae mirabilis* Perkins, female; $\times 11$.



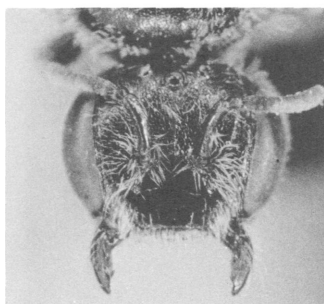
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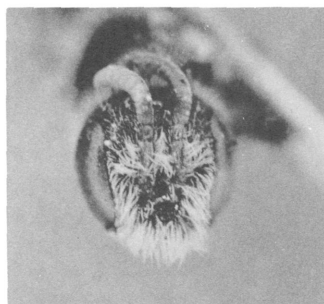
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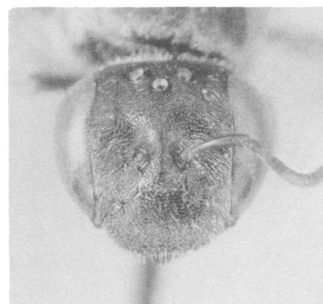
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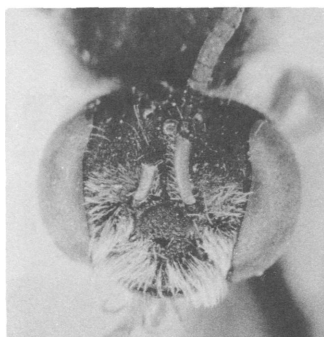
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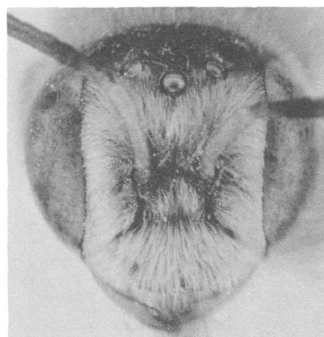
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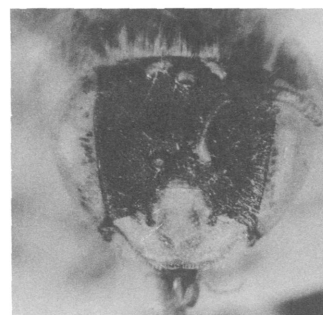
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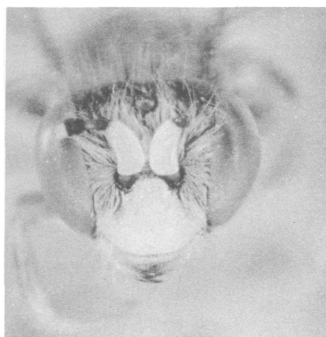
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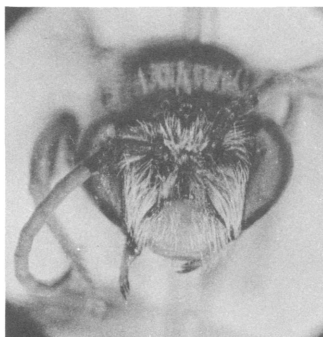
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PLATE 4

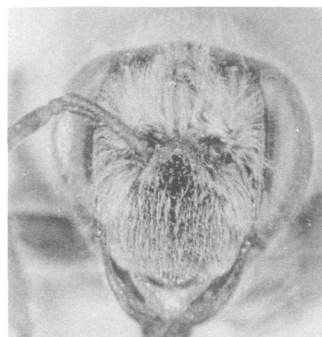
1. *Neopasiphae simplicior*, new species, holotype male; $\times 11$. 2. *Hesperocolletes douglasi*, new species, holotype male; $\times 7.5$. 3. *Paracolletes* (*Paracolletes*) *crassipes* Smith, female; $\times 9$. 4. *Paracolletes* (*Paracolletes*) *crassipes* Smith, male; $\times 11$. 5. *Paracolletes* (*Anthoglossa*) *nigrocinctus* Cockerell, female; $\times 9$. 6. *Paracolletes* (*Anthoglossa*) *callander* Cockerell, male; $\times 9$. 7. *Trichocolletes* (*Trichocolletes*) *burnsi*, new species, holotype female; $\times 7.5$. 8. *Trichocolletes* (*Trichocolletes*) *venustus* (Smith), female; $\times 9$. 9. *Trichocolletes* (*Trichocolletes*) *marginatulus*, new species, holotype female; $\times 9$. 10. *Trichocolletes* (*Trichocolletes*) *marginatulus*, new species, paratype male; $\times 11$. 11. *Trichocolletes* (*Callocolletes*) *pulcherrimus*, new species, allotype female; $\times 7.5$. 12. *Trichocolletes* (*Callocolletes*) *pulcherrimus*, new species, holotype male; $\times 7.5$.



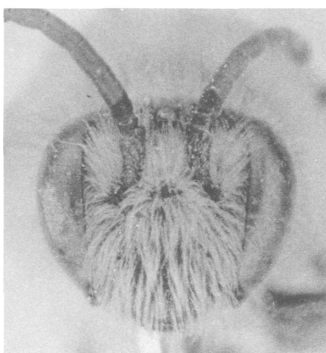
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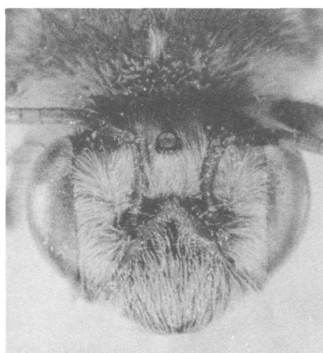
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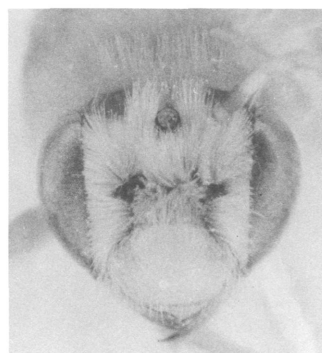
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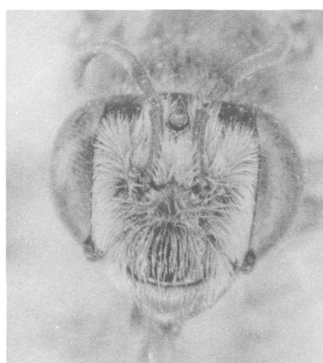
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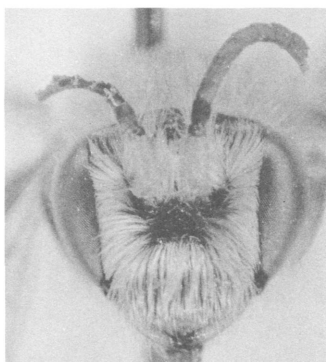
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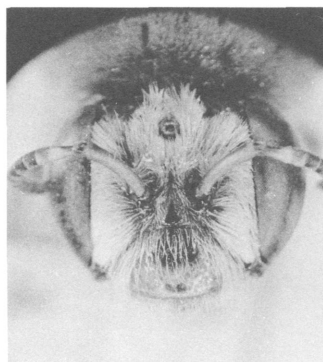
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9



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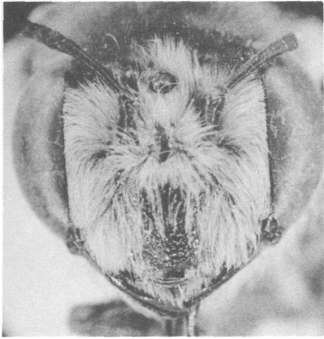
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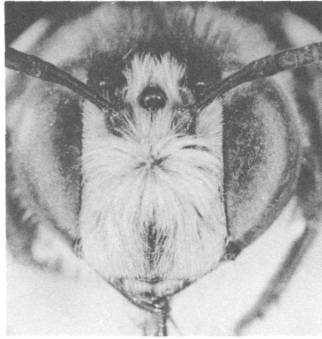
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PLATE 5

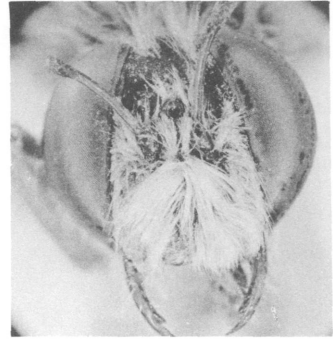
1. *Ctenocolletes albomarginata*, new species, paratype female; $\times 7.5$. 2. *Ctenocolletes albomarginatus*, new species, male; $\times 7.5$. 3. *Ctenocolletes notabilis*, new species, holotype male; $\times 7.5$. 4. *Ctenocolletes ordensis*, new species, holotype male; $\times 7.5$. 5. *Euryglossa (Euhesma) perkinsi*, new species, holotype female; $\times 18.5$. 6. *Euryglossa (Euhesma) platyrhina* Cockerell, female; $\times 18.5$. 7. *Euryglossa (Euhesma) palpalis*, new species, holotype female; $\times 18.5$. 8. *Euryglossa (Euhesma) palpalis*, new species, allotype male; $\times 18.5$. 9. *Euryglossa (Euhesma) hyphesmoides*, new species, holotype female; $\times 18.5$. 10. *Euryglossa (Euhesma) australis*, new species, holotype female; $\times 18.5$. 11. *Euryglossa (Euhesma) wahlenbergiae*, new species, holotype female; $\times 18.5$. 12. *Euryglossa (Euhesma) wahlenbergiae*, new species, allotype male; $\times 18.5$.



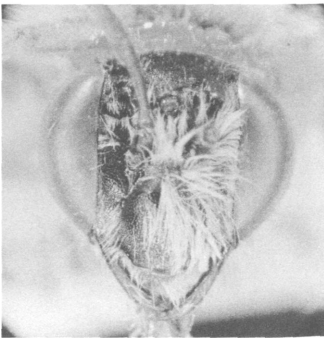
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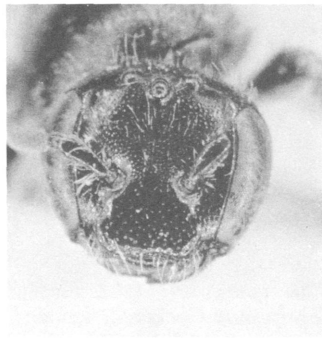
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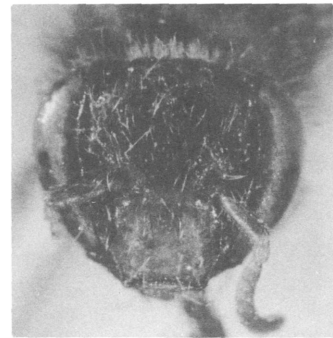
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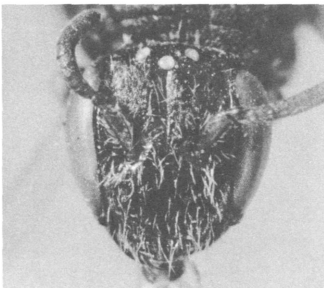
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5



6



7



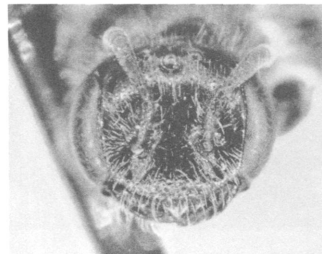
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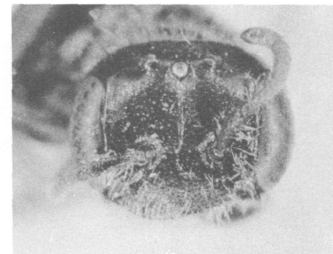
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11



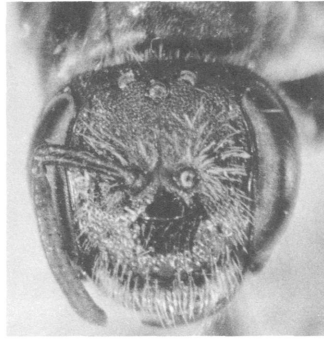
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PLATE 6

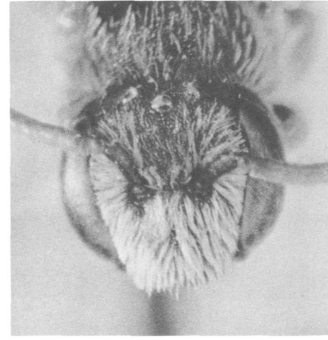
1. *Euryglossa* (*Parahesma*) *tuberculipes*, new species, holotype female; $\times 18.5$.
2. *Euryglossa* (*Euryglossa*) *subsericea* Cockerell, female; $\times 15.5$.
3. *Euryglossa* (*Euryglossa*) *chrysoceras* Cockerell, male; $\times 18.5$.
4. *Euryglossa* (*Callohesma*) *lacteipennis*, new species, holotype female; $\times 18.5$.
5. *Euryglossa* (*Callohesma*) *sulphurea*, new species, paratype female; $\times 18.5$.
6. *Euryglossa* (*Callohesma*) *calliopsiformis* Cockerell, female; $\times 18.5$.
7. *Euryglossa* (*Callohesma*) *calliopsiformis* Cockerell, male; $\times 18.5$.
8. *Euryglossa* (*Xenohesma*) *flavicauda*, new species, holotype male; $\times 18.5$.
9. *Euryglossa* (*Xenohesma*) *scutellaris*, new species, holotype female; $\times 18.5$.
10. *Euryglossa* (*Xenohesma*) *federalis*, new species, holotype female; $\times 18.5$.
11. *Euryglossa* (*Xenohesma*) *evansi*, new species, holotype male; $\times 18.5$.
12. *Euryglossa* (*Xenohesma*) *clypearis*, new species, paratype female; $\times 18.5$.
13. *Xanthesma* *nigrior*, new species, allotype female; $\times 18.5$.



1



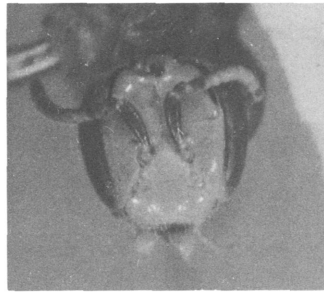
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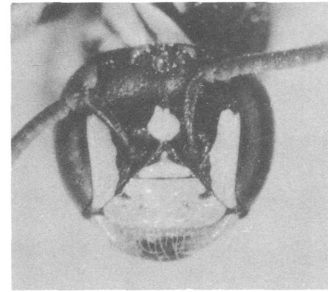
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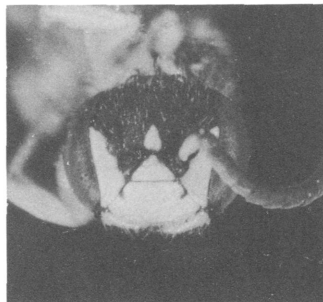
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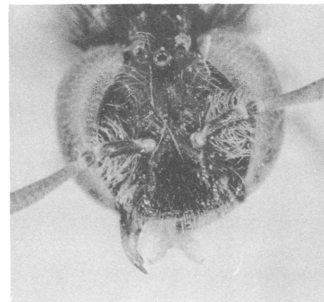
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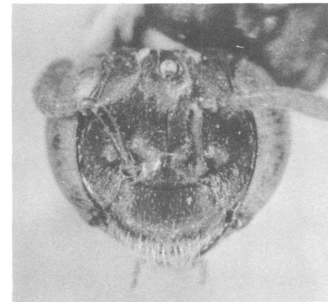
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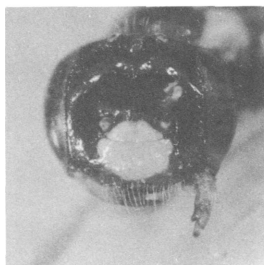
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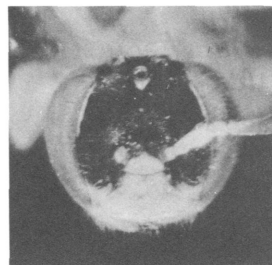
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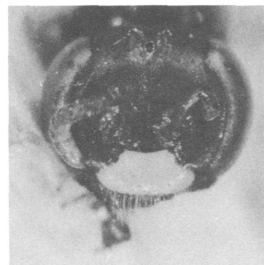
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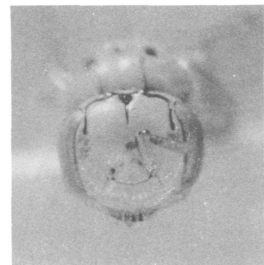
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11



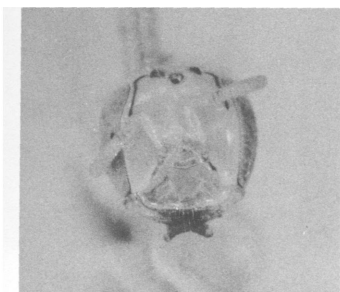
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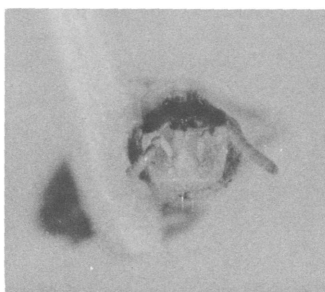
13

PLATE 7

1. *Xanthesma flava*, new species, holotype female; $\times 18.5$. 2. *Xanthesma nigrior*, new species, holotype male; $\times 18.5$. 3. *Heterohesma clypeata* (Rayment), cotype female; $\times 15.5$. 4. *Stenohesma nomadiformis*, new species, holotype female; $\times 15.5$. 5. *Stenohesma nomadiformis*, new species, allotype male; $\times 15.5$. 6. *Stilpnosoma laevigatum* Smith, female; $\times 15.5$. 7. *Holohesma semisericea* (Cockerell), female; $\times 15.5$. 8. *Holohesma semisericea* (Cockerell), male; $\times 15.5$. 9. *Dasyhesma robusta*, new species, holotype female; $\times 14$. 10. *Hyphesma barbata* (Cockerell), female; $\times 18.5$. 11. *Hyphesma nitidiceps* (Cockerell), male; $\times 18.5$. 12. *Pachyprosopis* (*Pachyprosopis*) *mirabilis* Perkins, female; $\times 18.5$. 13. *Pachyprosopis* (*Pachyprosopis*) *mirabilis* Perkins, male; $\times 18.5$.



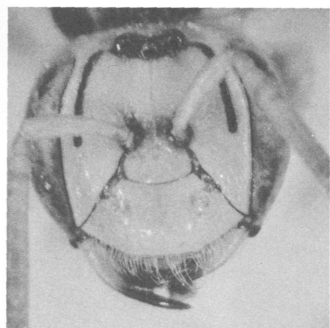
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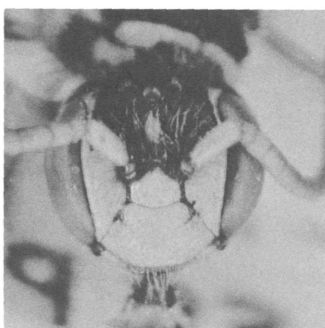
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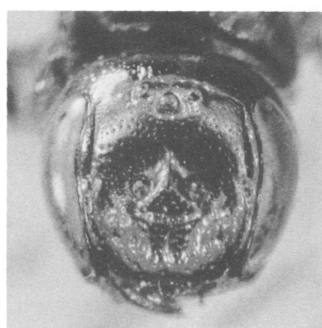
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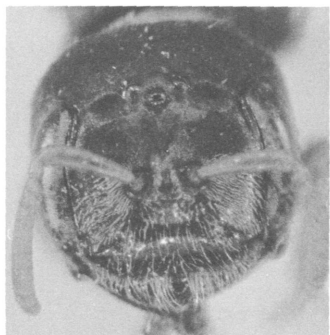
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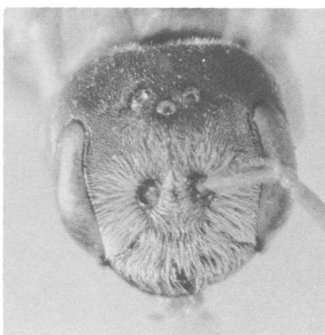
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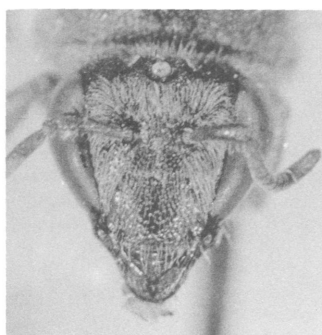
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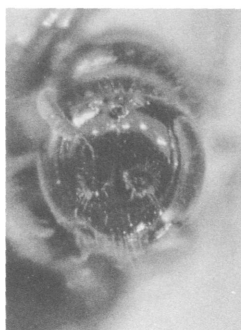
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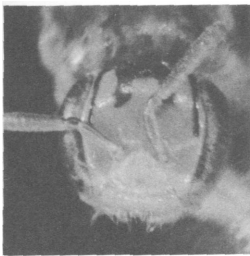
12



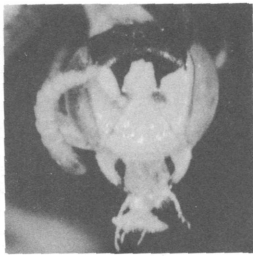
13

PLATE 8

1. *Pachyprosopis* (*Pachyprosopula*) *kelleys* Cockerell, female; $\times 18.5$.
2. *Pachyprosopis* (*Pachyprosopula*) *humeralis* Cockerell, male; $\times 18.5$.
3. *Euryglossina* (*Turnerella*) *nothula* (Cockerell), female; $\times 18.5$.
4. *Euryglossina* (*Turnerella*) *flavolateralis* Michener, female; $\times 18.5$.
5. *Euryglossina* (*Euryglossina*) *intermedia*, new species, holotype female; $\times 18.5$.
6. *Euryglossina* (*Euryglossina*) *intermedia*, new species, allotype male; $\times 18.5$.
7. *Euryglossina* (*Euryglossella*) *perkinsi*, new species, holotype female; $\times 18.5$.
8. *Euryglossina* (*Microdontura*) *mellea* (Cockerell), female; $\times 18.5$.
9. *Euryglossula* *chalicosoma* (Cockerell), female; $\times 18.5$.
10. *Euryglossula* *chalicosoma* (Cockerell), male; $\times 18.5$.
11. *Brachyhesma* (*Brachyhesma*) *sulphurella* (Cockerell), female; $\times 18.5$.
12. *Brachyhesma* (*Microhesma*) *incompleta*, new species, holotype female; $\times 18.5$.
13. *Brachyhesma* (*Microhesma*) *incompleta*, new species, allotype male; $\times 18.5$.
14. *Brachyhesma* (*Microhesma*) *cooki*, new species, holotype male; $\times 18.5$.
15. *Hylaeus* (*Prosopistemon*) *serotinellus* (Cockerell), female; $\times 18.5$.
16. *Hylaeus* (*Prosopistemon*) *serotinellus* (Cockerell), male; $\times 18.5$.
17. *Hylaeus* (*Prosopistemon*) *albozebrata*, new species, holotype male; $\times 18.5$.
18. *Hylaeus* (*Prosopistemon*) *simplex*, new species, holotype female; $\times 11$.
19. *Hylaeus* (*Prosopistemon*) *douglasi*, new species, holotype male; $\times 11$.
20. *Hylaeus* (*Edriohylaeus*) *ofarrelli*, new species, allotype female; $\times 18.5$.
21. *Hylaeus* (*Edriohylaeus*) *ofarrelli*, new species, holotype male; $\times 18.5$.



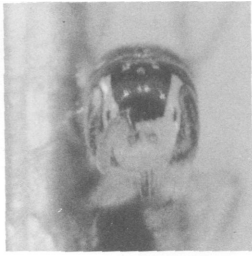
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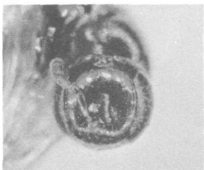
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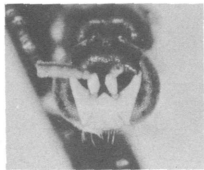
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4



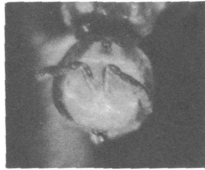
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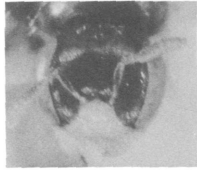
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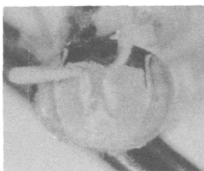
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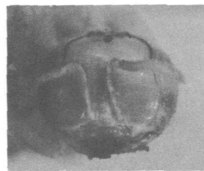
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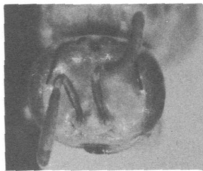
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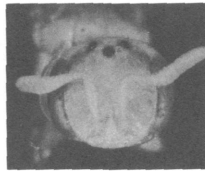
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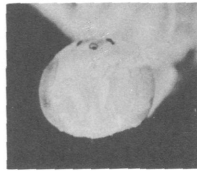
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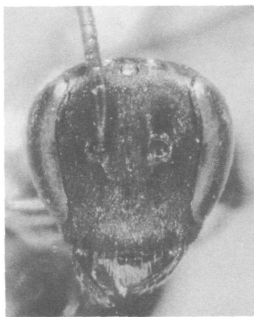
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13



14



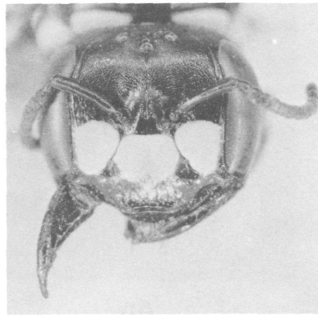
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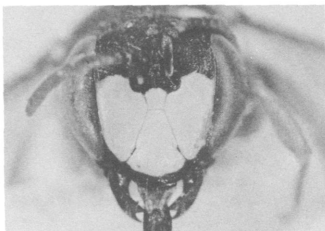
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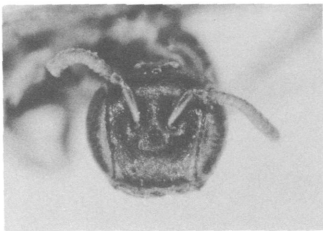
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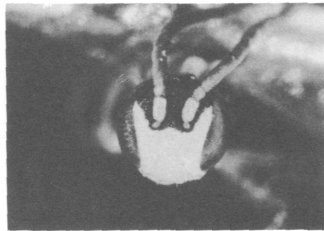
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19



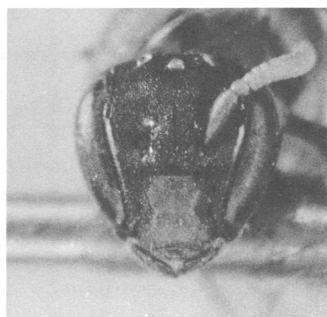
20



21

PLATE 9

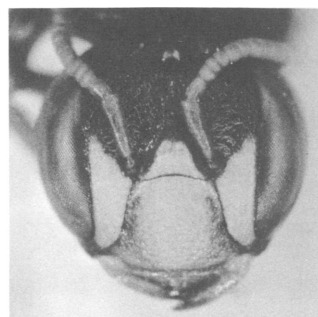
1. *Hylaeus* (*Rhodohylaeus*) *ceniberus* (Cockerell), female; $\times 18.5$.
2. *Hylaeus* (*Rhodohylaeus*) *ceniberus* (Cockerell), male; $\times 18.5$.
3. *Hylaeus* (*Hylaeteron*) *hemirhodus*, new species, holotype female; $\times 18.5$.
4. *Hylaeus* (*Gnathoprosopoides*) *eburniellus* (Cockerell), female; $\times 18.5$.
5. *Hylaeus* (*Gnathoprosopoides*) *eburniellus* (Cockerell), male; $\times 18.5$.
6. *Hylaeus* (*Gnathoprosopis*) *amiculinus* (Cockerell), female; $\times 18.5$.
7. *Hylaeus* (*Gnathoprosopis*) *hackeri* (Cockerell), male; $\times 18.5$.
8. *Hylaeus* (*Sphaerhylaeus*) *globulifer* (Cockerell), male; $\times 11$.
9. *Hylaeus* (*Euprosopis*) *disjunctus* (Cockerell), female; $\times 15.5$.
10. *Hylaeus* (*Euprosopis*) *disjunctus* (Cockerell), male; $\times 15.5$.
11. *Hylaeus* (*Euprosopis*) *elegans* (Smith), female; $\times 15.5$.
12. *Hylaeus* (*Euprosopis*) *elegans* (Smith), male; $\times 15.5$.
13. *Hylaeus* (*Euprosopoides*) *ruficeps* (Smith), female; $\times 15.5$.



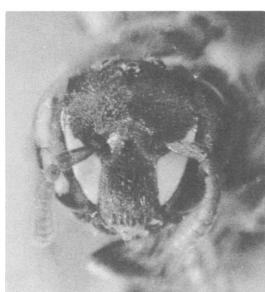
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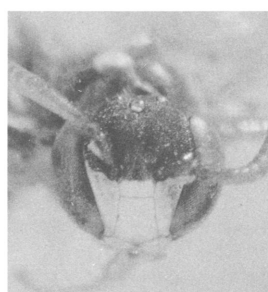
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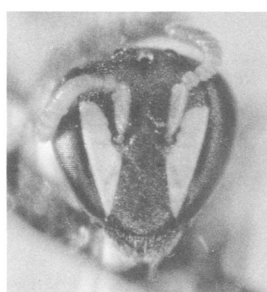
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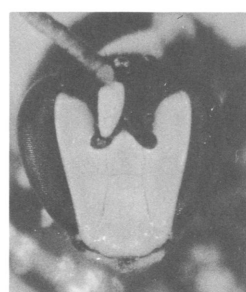
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5



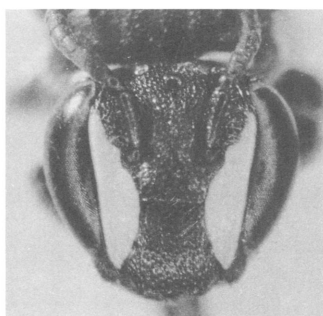
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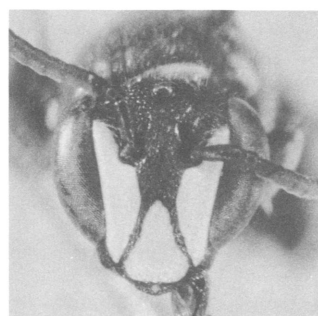
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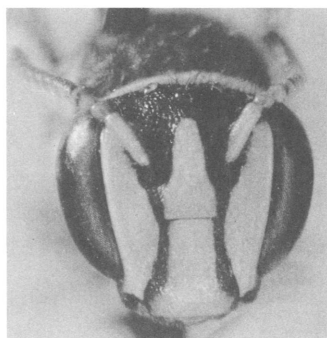
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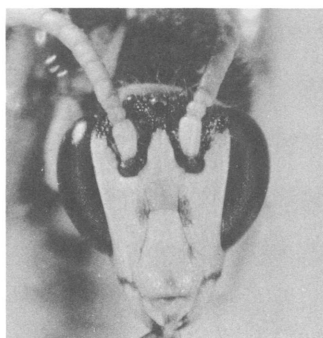
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10



11



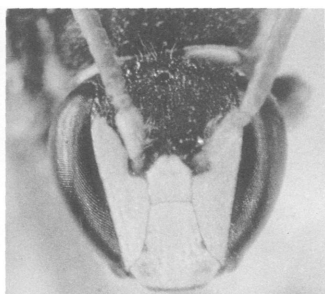
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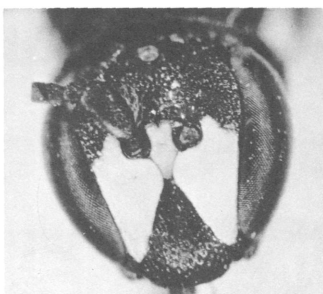
13

PLATE 10

1. *Hylaeus (Euprosopoides) ruficeps* (Smith), male; $\times 15.5$. 2. *Hylaeus (Euprosopoides) perconvergens*, new species, paratype male; $\times 18.5$. 3. *Hylaeus (Macrohylaeus) alcyoneus* (Erichson), female; $\times 9$. 4. *Hylaeus (Macrohylaeus) alcyoneus* (Erichson), male; $\times 11$. 5. *Hylaeus (Meghylaeus) fijiensis* (Cockerell), female; $\times 9$. 6. *Hylaeus (Pseudhylaeus) multigibbosus*, allotype female, $\times 15.5$. 7. *Hylaeus (Pseudhylaeus) multigibbosus*, new species, holotype male; $\times 15.5$. 8. *Hylaeus (Xenohylaeus) scutaticornis*, new species, allotype female; $\times 15.5$. 9. *Hylaeus (Xenohylaeus) scutaticornis*, new species, holotype male; $\times 15.5$. 10. *Hylaeus (Xenohylaeus) ricki*, new species, allotype female; $\times 15.5$. 11. *Hylaeus (Xenohylaeus) ricki*, new species, holotype male; $\times 15.5$. 12. *Heterapoides bacillaria* (Cockerell), female; $\times 18.5$. 13. *Heterapoides bacillaria* (Cockerell), male; $\times 18.5$.



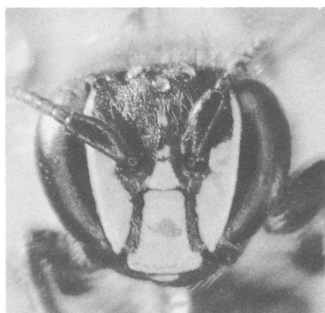
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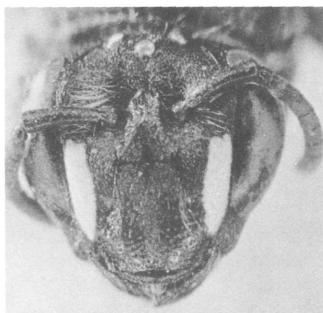
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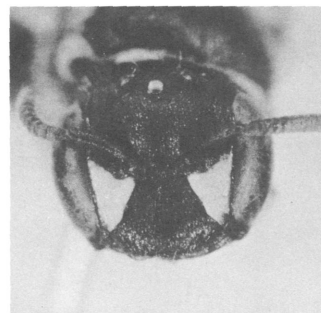
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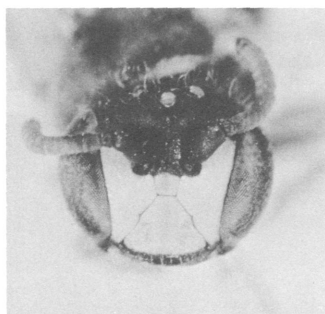
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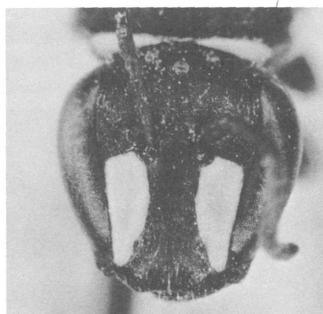
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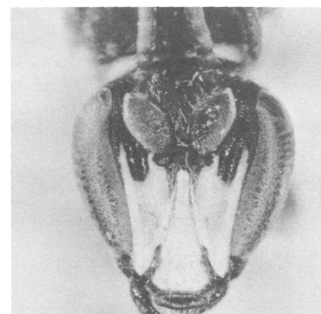
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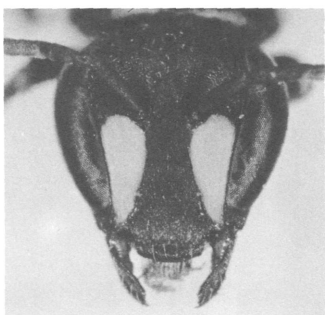
7



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PLATE 11

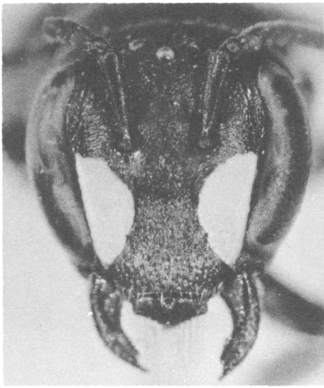
1. *Gephyryhylaesus sandacanensis* (Cockerell), female; $\times 18.5$. 2. *Gephyryhylaesus sandacanensis* (Cockerell), male; $\times 18.5$. 3. *Analastoroides foveata* Rayment, holotype female; $\times 14$. 4. *Pharohylaesus lactiferus* (Cockerell), male; $\times 11$. 5. *Hylaeorhiza nubilosa* (Smith), female; $\times 15.5$. 6. *Hylaeorhiza nubilosa* (Smith), male; $\times 15.5$. 7. *Hylaeorhiza burnsi*, new species, holotype female; $\times 11$. 8. *Palaeorhiza* (*Palaeorhiza*) *disrupta* Cockerell, female; $\times 15.5$. 9. *Palaeorhiza* (*Palaeorhiza*) *disrupta* Cockerell, male; $\times 15.5$. 10. *Palaeorhiza* (*Palaeorhiza*) *flavomellea* Cockerell, female; $\times 18.5$. 11. *Palaeorhiza* (*Palaeorhiza*) *flavomellea* Cockerell, male; $\times 18.5$. 12. *Palaeorhiza* (*Anchirhiza*) *mandibularis*, new species, holotype female; $\times 14$. 13. *Palaeorhiza* (*Palaeorhiza*) *infuscata*, new species, paratype male; $\times 14$.



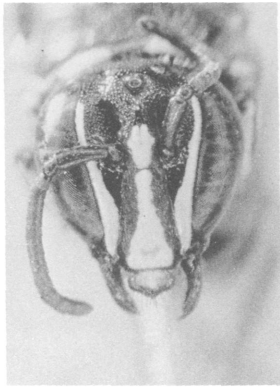
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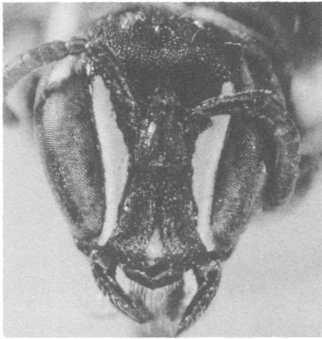
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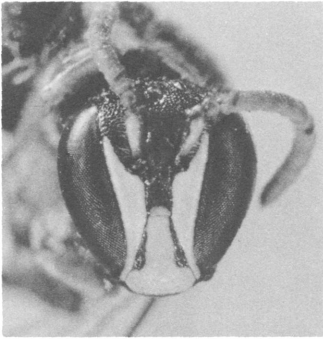
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4



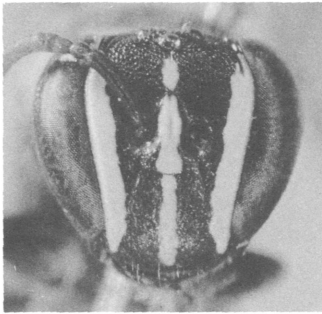
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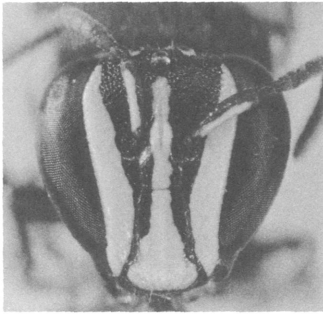
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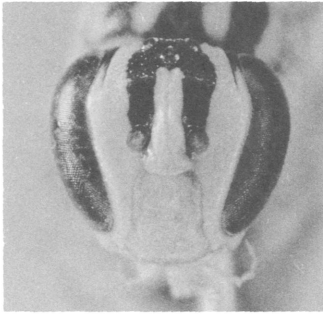
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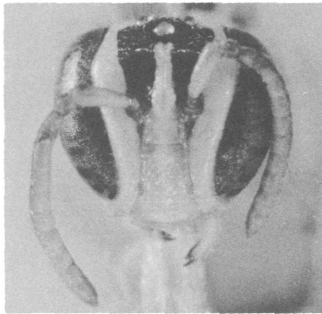
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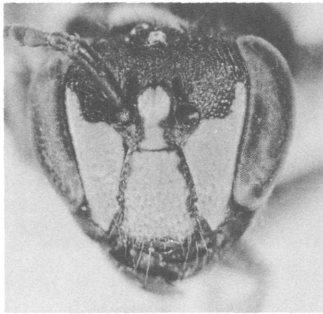
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10



11



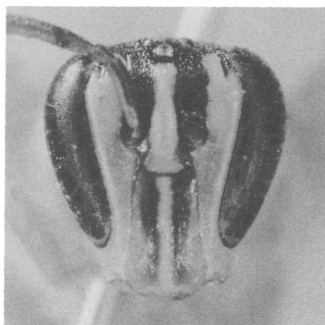
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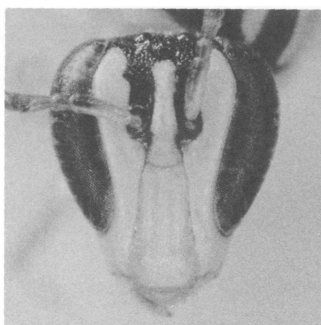
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PLATE 12

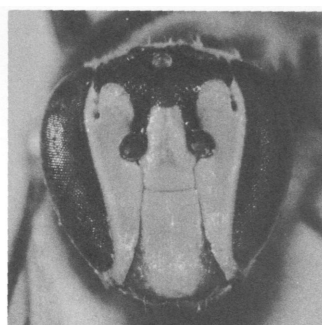
1. *Palaeorhiza (Heterorhiza) melanura* Cockerell, female; $\times 14$. 2. *Palaeorhiza (Heterorhiza) melanura* Cockerell, male; $\times 14$. 3. *Hemirhiza melliceps* (Cockerell), female; $\times 18.5$. 4. *Hemirhiza melliceps* (Cockerell), male; $\times 18.5$. 5. *Amphylaeus (Agogenohylaeus) nubilosellus mediotinctus* (Cockerell), female; $\times 18.5$. 6. *Amphylaeus (Agogenohylaeus) nubilosellus mediotinctus* (Cockerell), male; $\times 18.5$. 7. *Amphylaeus (Amphylaeus) morosus* (Smith), female; $\times 9$. 8. *Amphylaeus (Amphylaeus) morosus* (Smith), male; $\times 9$. 9. *Meroglossa canaliculata* Smith, female; $\times 9$. 10. *Meroglossa canaliculata* Smith, male; $\times 9$. 11. *Meroglossa torrida* (Smith), male; $\times 15.5$. 12. *Hyleoides concinna* (Fabricius), female; $\times 9$.



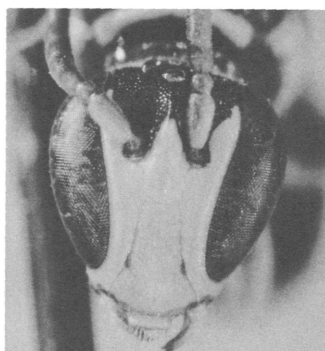
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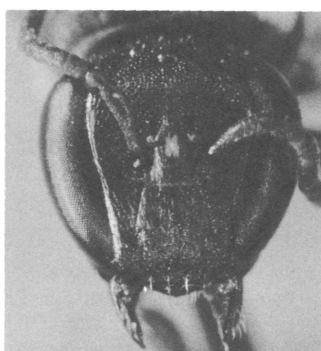
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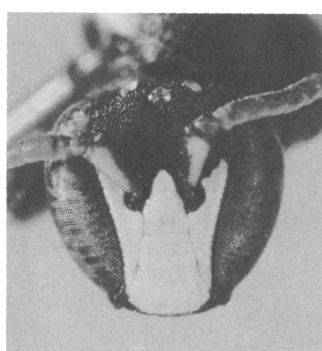
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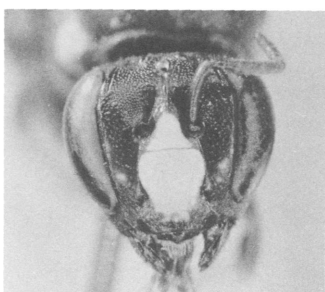
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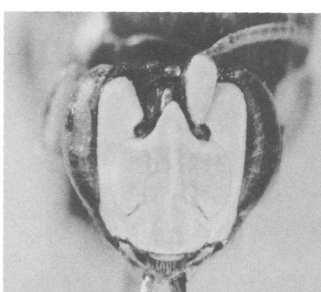
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6



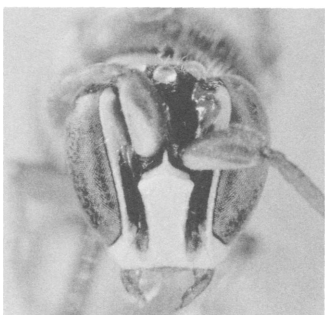
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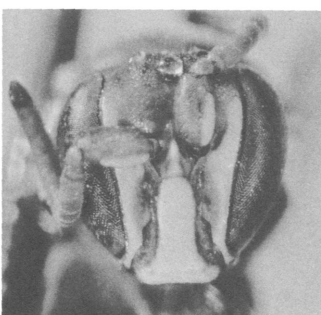
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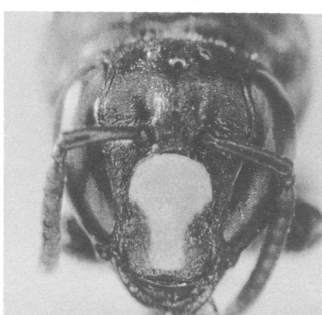
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10



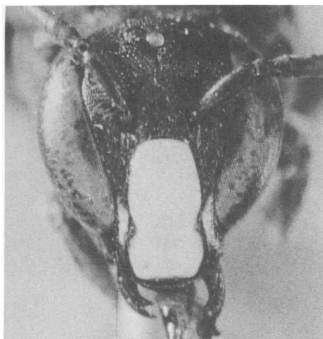
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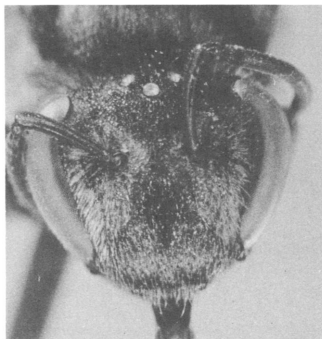
12

PLATE 13

1. *Hyleoides concinna* (Fabricius), male; $\times 9$.
2. *Nomia* (*Austronomia*) *maai*, new species, paratype female; $\times 14$.
3. *Nomia* (*Melittidia*) *simplicinotum*, new species, paratype female, $\times 9$.
4. *Nomia* (*Melittidia*) *gressitti*, new species, paratype female; $\times 9$.
5. *Nomia* (*Melittidia*) *gressitti*, new species, paratype male; $\times 9$.
6. *Nomia* (*Ptilonomia*) *plumosa*, paratype female; $\times 7.5$.
7. *Nomia* (*Ptilonomia*) *plumosa*, new species, paratype male; $\times 7.5$.
8. *Nomia* (*Reepenia*) *bituberculata* (Smith), female; $\times 9$.
9. *Nomia* (*Reepenia*) *bituberculata* (Smith), male; $\times 9$.
10. *Lasioglossum* (*Chilalictus*) *wahlenbergiae*, new species, paratype female; $\times 18.5$.
11. *Lasioglossum* (*Chilalictus*) *wahlenbergiae*, new species, paratype male; $\times 18.5$.
12. *Lasioglossum* (*Chilalictus*) *gynochilum*, new species, paratype female; $\times 18.5$.



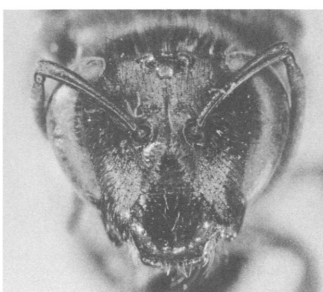
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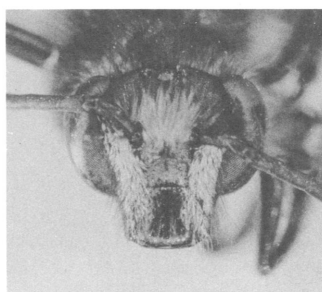
2



3



4



5



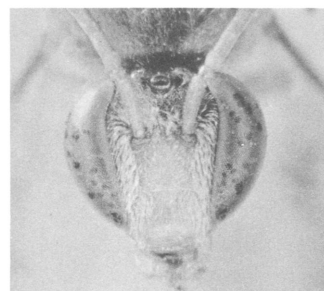
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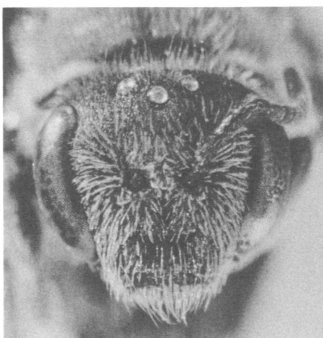
7



8



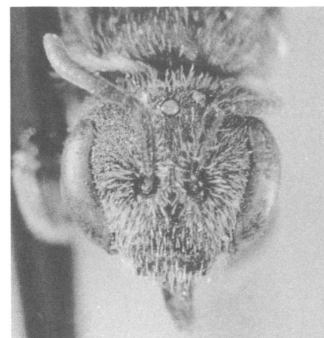
9



10



11



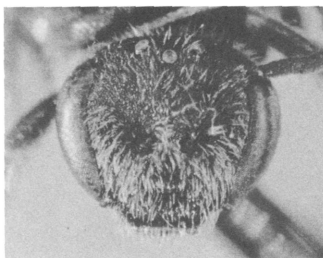
12

PLATE 14

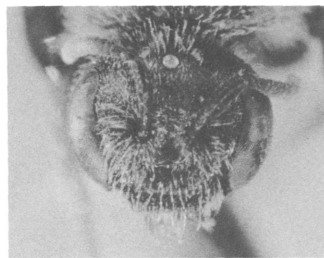
1. *Lasioglossum* (*Chilalictus*) *gynochilum*, new species, paratype male; $\times 18.5$.
2. *Lasioglossum* (*Chilalictus*) *cephalochilum*, new species, paratype female; $\times 18.5$.
3. *Lasioglossum* (*Chilalictus*) *obscurissimum*, new species, type female; $\times 18.5$.
4. *Lasioglossum* (*Chilalictus*) *obscurissimum*, new species, allotype male; $\times 18.5$.
5. *Lasioglossum* (*Australictus*) *fulvofasciae*, new species, holotype female; $\times 15.5$.
6. *Lasioglossum* (*Australictus*) *fulvofasciae*, new species, allotype male; $\times 15.5$.
7. *Lasioglossum* (*Pseudochilalictus*) *imitator*, new species, paratype female; $\times 14$.
8. *Homalictus szentivanyi* (Michener), paratype female; $\times 18.5$.
9. *Homalictus szentivanyi* (Michener), paratype male; $\times 18.5$.
10. *Homalictus ctenander*, new species, holotype female; $\times 15.5$.
11. *Echthralictus extraordinarius* (Kohl), female; $\times 15.5$.
12. *Homalictus ctenander*, new species, allotype male; $\times 15.5$.



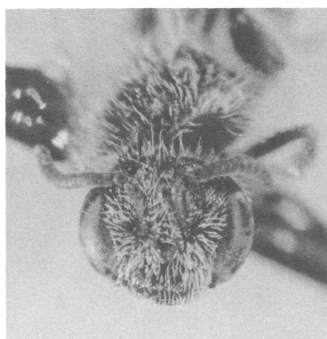
1



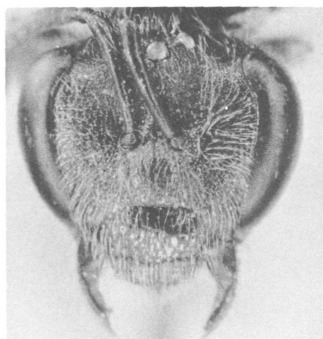
2



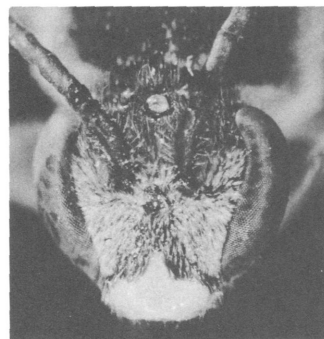
3



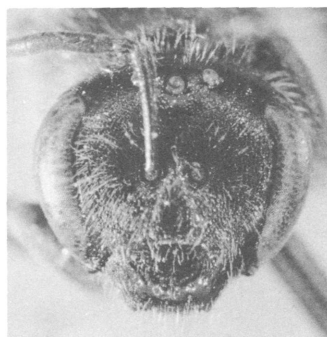
4



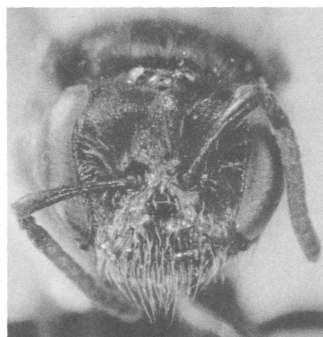
5



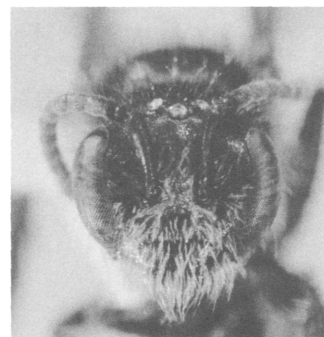
6



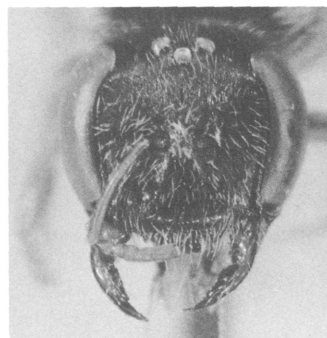
7



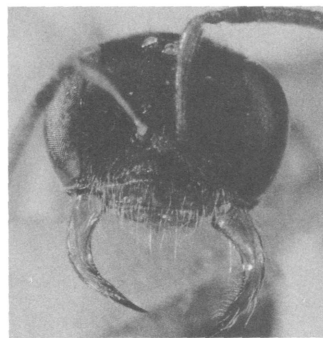
8



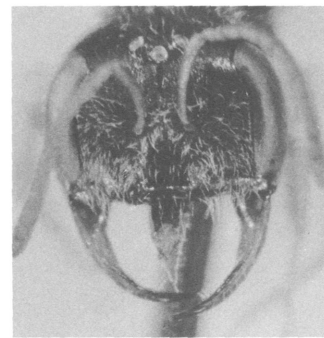
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10



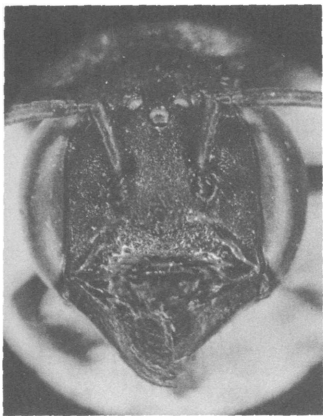
11



12

PLATE 15

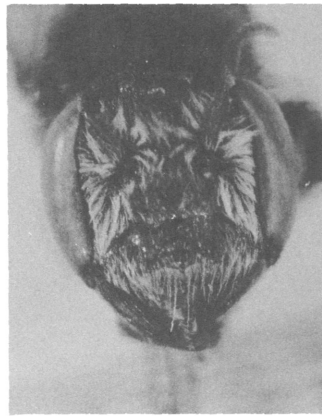
1. *Chalicodoma* (*Callomegachile*) *szentivanyi*, new species, holotype female; $\times 7$. 2. *Chalicodoma* (*Chalicodomoides*) *aethiops* (Smith), female; $\times 7$. 3. *Chalicodoma* (*Hackeriapis*) *papuae*, new species, holotype female; $\times 11$. 4. *Exoneura* (*Exoneurella*) *lawsoni* Rayment, female; $\times 18.5$. 5. *Exoneura* (*Exoneurella*) *lawsoni* Rayment, male; $\times 18.5$. 6. *Exoneura* (*Brevineura*) *concinna* Cockerell, male; $\times 18.5$. 7. *Exoneura* (*Brevineura*) *concinna* Cockerell, female; $\times 18.5$. 8. *Exoneura* (*Exoneura*) *variabilis* Rayment, male; $\times 18.5$. 9. *Exoneura* (*Exoneura*) *variabilis* Rayment, female; $\times 18.5$. 10. *Exoneura* (*Exoneura*) *bicolor* Smith, female; $\times 15.5$. 11. *Exoneura* (*Exoneura*) *bicolor* Smith, male; $\times 14$. 12. *Exoneura* (*Exoneura*) *obscuripes* Michener, female; $\times 15.5$.



1



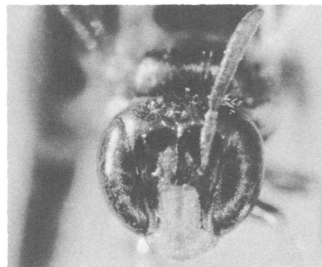
2



3



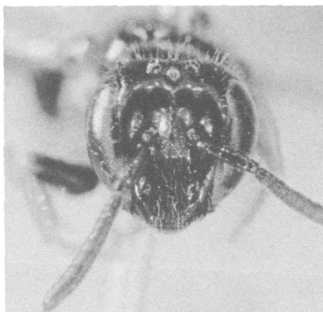
4



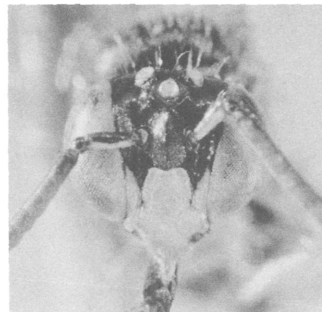
5



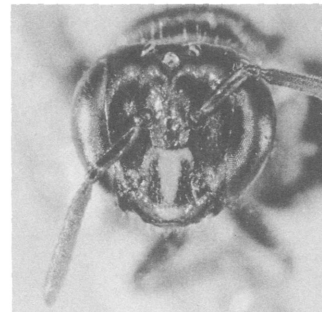
6



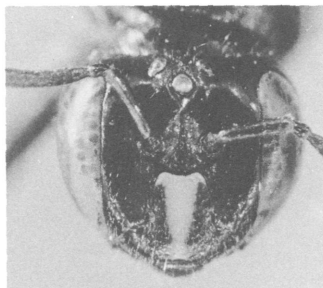
7



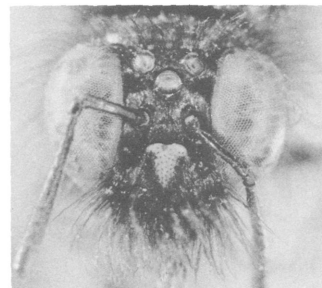
8



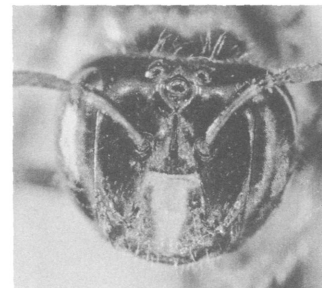
9



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12